RAILROAD GAZETTE

FRIDAY, FEBRUARY 19.

Contributions.

The Preservation of Timber.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The American Society of Civil Engineers in 1880 appointed a committee to investigate and report on the best means for the preservation of timber, which submitted an elaborate and able report at the annual convention of the Society held June 25, 1885. It deals with the subject from a purely practical and business stand-point, and with a brevity which in some instances will be regretted by those who take a more than common interest in it. An index of the works extant on the subject would have been of much assistance to those who might desire to investigate more minutely, and might well have been added.

Probably few persons are aware of the great financial importance of timber preservation. The number of ties at present in the tracks of all the railroads of the United States is, in round numbers, 500,000,000; their average life, without preservative treatment, some 6½ years, necessitating an annual renewal of 77,000,000 ties costing laid in the track say 50 cents each, or $38,000,000.*

Now, it has been thoroughly demonstrated that by proper treatment with antiseptics at a cost not exceeding 25 cents per tie, its life can be doubled. On this basis, therefore, there would be a gross annual saving of about $9,600,000. The prolongation of the life of timber used for other purposes, as bridges, wharves and wooden ships, would effect a saving at least equal in amount.

As respects decay of timber, the researches of Pasteur and others show that the atmosphere is filled with minute germs of various species of animals and plants ready to develop as soon as they reach a congenial locality. The generally accepted conclusion is that all fermentation, which is the proximate cause of decay in timber, is caused by the germination of such infinitesimal spores, which elude observation on account of their size; some not exceeding 1-240,000 of an inch in diameter.

It has been ascertained that the temperature best suited for the existence of such germs is from 50° to 80° Fahr. Temperatures above or below these render their action slow or cause it cease altogether; they may, however, be revived, and their action recommence, by the proper change of temperature. Tyndall found that they were not completely destroyed until the air containing them was passed through a red hot platinum tube, and it is not known how low a temperature they can endure.

The second and much more rapid cause of the destruction of timber is the ravages of boring insects, of which the teredo, a marine worm of which several species are known to exist, is best known. The manner in which this worm causes the destruction of wood is practically the same as that of the germs which cause "decay"; in both cases the animal feeds upon the wood, although in the teredo, on account of its size, we can witness the details of its apparatus for boring and digesting, which the small size of the germs renders impossible. The teredo is a terrible creature; it exists in all sea water not included in the Arctic and Antarctic circles, and its ravages have even been sufficient to check the commercial progress of seaboard towns.

The destructive powers are very great. There is a well authenticated case of a stranded vessel having lost half the weight of her wooden hull in six months from this cause. Oak timber has been so completely honeycombed by these worms that a piece 7 in. in length and 11 in. in circumference weighed less than four ounces, and the writer has seen a piece of a pile 4 ft. long by 15 in. in diameter when taken from the waters of the Gulf of Mexico so filled with living teredos that it resembled a piece of honeycomb filled with bees at work, and only sustained its own weight by the shell-like lining constructed by the teredo itself.

It is evident from the fact that the destruction of timber is caused by its becoming the prey of animal and vegetable life, that any preservative process must possess the quality of rendering the wood unsuitable for becoming the food of such organisms. Poisonous mineral salts only effect this object partly, by destroying the germs existing in the wood at the time of the injection of the salt in a liquid state, and also by closing the pores of the wood and thus preventing their future admission and compelling them to commence their work from the outside. The coagulation of the albumen of the wood does not, however, render it unfit for the food of these organisms, which are able to resist conditions fatal to higher ones. A poisonous salt like corrosive sublimate, which would be fatal to animal life, may be rendered harmless when combined with albumen in the coagulated state, and would in that state be as suitable for the food of germs and boring insects as before.

The only agent which has been found capable of fulfilling all of the necessary conditions, viz., the destruction of all forms of germ and insect life, the coagulation of the albumen, and the effectual closing of the pores of the wood against air and moisture, is the oily product of the destructive distillation of organic substances containing creosote or its analogues.

The only objection to these oils is their consistency, which prevents their injection into the heart-wood, which, therefore, in time decays; but this objection only applies to the dense hard woods, and not to those of a more porous nature, the writer having found that in the case of the latter woods a substance as viscid as wood tar, or the heaviest "dead oil," containing a large percentage of naphthaline, may be easily caused to permeate every fibre, both of sap and heart. The substance which the committee most strongly recommend for cross ties is chloride of zinc; but the objection stated above applies to this salt in common with all others, and in order to render its use thoroughly effectual, it would have to be supplemented by a treatment with some substance capable of closing the pores of the wood against moisture, as chloride of zinc is a deliquescent salt, whereas with creosote oil but one operation is required.*

There are, no doubt, many cases where that process which is expedient rather than that which is really the best will be adopted, and the kind of treatment, or indeed any treatment at all, will depend largely upon the financial condition of the particular road considering it.

The most perfect system of rendering timber indestructible should begin with a selection of the proper time for felling the trees, which should be done when the wood contains the least sap, in order to facilitate the subsequent introduction of antiseptics and diminish its expense.

Wood cut in the month of December allows no water to pass through it longitudinally; wood cut in January allowed a few drops to pass in 48 hours; wood cut in February allowed two quarts to pass in 48 hours; while wood cut in March allowed two quarts to pass in 2½ hours.

It must be borne in mind that sap is nothing but water charged with resinous, saccharine, saline, mucilaginous and albuminous matters, a mixture exceedingly favorable for fermentation, and that obviating its presence by cutting the wood at the proper season is a much easier and less expensive method than to remove it later.

After the wood has been felled it should be worked into the required shape and then allowed a sufficient time to become air-dried, and in the case of large sticks of the denser hard woods a hole should be bored longitudinally through the heart to permit the oil to be more readily injected throughout its substance.

When placed in the injecting vessel it should be heated in a vacuum to say 250° Fahr. (not steamed), and the hot oil immediately afterward injected under powerful pressure. The apparatus for injecting the preservative consists principally of a very strong air-tight cylinder, and its vacuum and pressure pumps and motive power for same, with the necessary iron tanks for containing and heating the oil.

The process of injection is a simple one, not requiring the use of any machinery liable to get out of order, and its cost, for a capacity of 1,000 ties per day, is only about $8,000. This capacity may be increased indefinitely by the addition of more cylinders, at, say, $1,000 each. Furthermore, as the report truly says, "success in timber preservation, by whatever method, depends upon the thoroughness with which the work is done, and no economy is so false as that which seeks to scrimp the legitimate cost."

As regards the duration of creosoted timber under any conditions of decay or the attacks of boring animals, the committee furnishes abundant evidence from experience both in this country and in Europe, sometimes under very imperfect treatment. Brunel, the eminent English engineer, stated that in his opinion creosoted timber would last for 40 years. Mr. Burt, of London, states that after an experience of 20 years, during which time he has creosoted and sent to India alone over 1,500,000 ties, besides having prepared many hundreds of thousands of cubic feet of timber for other purposes, that the instances of failure have been rare and isolated; in fact, there is so much corroborative evidence on this point that a proper treatment with "dead oil" may be safely regarded as infallible under all circumstances. It may be noted that the kind of oil preferred by continental engineers is *thick* and rich in napthaline, thereby proving that they prefer a material which, although penetrating but a short distance into the wood, furnishes a waterproof covering, to one capable of penetrating the wood to a greater depth, but not closing the outer covering so effectually. This seems bad practice and must result sooner or later in decay of the heart wood not penetrated by the oil.

The mechanical effects of creosoting are to render the timber more dense and give it greater tenacity for spikes, presenting, in this respect, a contrast to the action of the solutions in water of the metallic salts, which are generally deliquescent and injurious to metallic fastenings, and tend also to render the wood brittle.

M. Forestier, a French engineer, cites a number of experiments with creosoted and uncreosoted wood, showing that resistance to bending and crushing was much increased by creosoting. In England, with "dead oil" at 4 cents per gallon, 50 cubic feet of timber can be creosoted for about $3 of which amount about $2.40 is for the preserving material.

A very serious obstacle to the general adoption of creosoting in the United States is the comparatively small amount of "dead oil" produced; coal tar, the crude material from which it is produced by distillation, is becoming less abundant every year in consequence of the general practice of making "water gas," which does not produce tar.

There is, however, a source from which a great abundance of an antiseptic material, fully equal if not superior to "dead oil," may be obtained, viz., the destructive distillation of wood for the manufacture of charcoal and the production therefrom of immense quantities of wood tar, yielding by distillation oils similar in composition to those obtained from coal tar, but having the advantage of containing the true "creosote," and in addition to these oils large quantities of pyroligneous acid, with which pyrolignite of iron, a very valuable antiseptic, can be produced at an almost nominal cost.

Great quantities of these valuable substances are being wasted every year by the charcoal iron manufacturers of this country, which, were there any demand for them, could be easily saved, and there is being wasted in the sawmills of the Southern states enough slabs and sawdust to furnish antiseptics for the whole railroad interest.

As to the value of these materials, wood tar, creosote oil and pyrolignite of iron, as antiseptics, there is abundant evidence. It has been known from the most ancient times that charring the outside of seasoned wood rendered it practically indestructible; such wood having been dug up perfectly sound after remaining buried in the ground for 1,500 years.

Now, when wood is charred in this manner what takes place is virtually the destructive distillation of the outer portion of the wood, and the impregnation of the remainder with the vapors of the creosote produced by the charring. Under the outer carbonized layer is found a scorched layer of wood which has been partly distilled and impregnated with the products of that distillation, viz., creosoted. Wood tar is well-known to possess powerful antiseptic properties, due to the creosote which it contains and it is much used in Europe for the preservation of wood, especially for wood used in shipbuilding.

Pyrolignite of iron, a solution of iron in pyroligneous acid, which holds more creosote in solution than any other watery menstruum, has been indorsed as a valuable antiseptic by many eminent European authorities, who state that it perfectly coagulates the sap of the wood and entirely prevents putrefaction or fermentation for an unlimited period. It has been successfully used for treating timber to be exposed to the attacks of marine animals, and its success in such cases must be attributed to the creosote contained in the pyroligneous acid from which the pyrolignite was prepared. It has the further advantage of being a thin liquid, capable of permeating completely the pores of the wood, and the low price at which it can be produced in this country enables it to compete successfully with any form of metallic salt used for similar purposes, while having the great advantage over all such salts of a large percentage of true creosote. Its use in England was abandoned because it could not compete in price there with "dead oil," but had there been an abundance of waste wood in England capable of producing large quantities of creosote, as is the case here, it would probably have been used there quite as extensively as "dead oil" has been.

The only references in the committee's report to the use of pyrolignite of iron or to the oils produced from the destructive distillation of wood are, one with pyrolignite of iron at Pottsville, Pa., in which it was attempted to impregnate the wood *by means of capillary action*, and another in North Carolina, in which it was attempted to treat the wood by placing it *in a bath of cold oil for three hours*. It will be seen that neither of these experiments prove that their failures was the fault of the antiseptic employed; indeed, it is probable that most of the failures recorded by the committee were due in greater measure to the improper treatment than to the use of an improper preserving substance.

The chemist of the Society appears to have made a discovery, as we find on page 283 of the report a statement that salt is a comparatively weak antiseptic, *its atomic weight* being 58 8 in the hydrogen scale, as against 135.5 for chloride of mercury!

It is usually considered that the atomic weight of a substance is simply an indication of the measure of its combining power with other substances, or, theoretically, a measure of its density, but it is new to have it advanced as a measure of its antiseptic quality; one might as well imagine its atomic weight to be an indication of its odor or taste.

Railroad corporations and all others interested will do well to give careful study to this report, which contains more practical information on the subject than has ever before been published. The Society and members of the committee deserve the thanks of the whole country for carrying through their arduous and expensive investigation, and the corporations with which so many of the members of the Society are connected either will or might benefit greatly by it.

* There are about 160,000 miles of railroad *track* in the United States, including all second track and sidings, and the number of ties in it can hardly be more than 4?5 millions "in round numbers." The average cost of ties is also less than 50 cents. In 1880 the census gave the cost of tie renewals for 108,000 miles of *track* as $10,741,577—as nearly as may be $100 per mile of track.

If the average life is 6½ years, 406 ties per mile are renewed making the average cost in 1880 only 25 cents per tie, instead of 50. Doubtless the Census figures in nearly all cases cover only the amount paid for ties where received, and not the cost of putting them in track and in many other cases are imperfect for lack of separate report of cost of ties, but the average is below 50 cts.

At this rate ($100 per mile of *track* per year) tie renewals will cost $16,000,000 in 1886 plus the cost of putting them in track; and to double their life (if it is 6½ years) would be worth $10 960 000 with interest at 6 per cent., $11,656,000 with interest at 5 per cent. and $12,888,000, with a proportional addition for cost, interest at 4 per cent; while the cost of doubling it at 25 cents per tie would be $16,000,000. Certainly the figures for cost of renewals given by the Census of 1880 must be increased considerably for cost of putting in track. But no company's action will be influenced by these or any other averages; it will be (or should be) governed entirely by the *cost on its own line;* and each company may know definitely what its ties cost it, how long they last, and what interest it has to pay for the use of money. From these data it is easy to calculate precisely what any addition to the life of its ties will be worth.—EDITOR.

* But the experience of the German Railroad Union, covering 40 years of time and more preserved ties, perhaps, than in all the world besides, is that ties treated with chloride of zinc last just as long as those treated with creosote (or dead oil, rather, in which analysis usually fails to find anything more than a trace of creosote), and chloride of zinc has almost superseded creosote in Germany and Austria.—EDITOR.

Locomotive Inspection Reports.

The system of locomotive inspection and reports instituted by Mr. Cushing on the Northern Pacific is admirable, and is worth the special attention of the mechanical department of other roads. Regular detailed reports are made to the superintendent of motive power from each of eight divisions. They include, first, a semi-monthly report of the location of en-

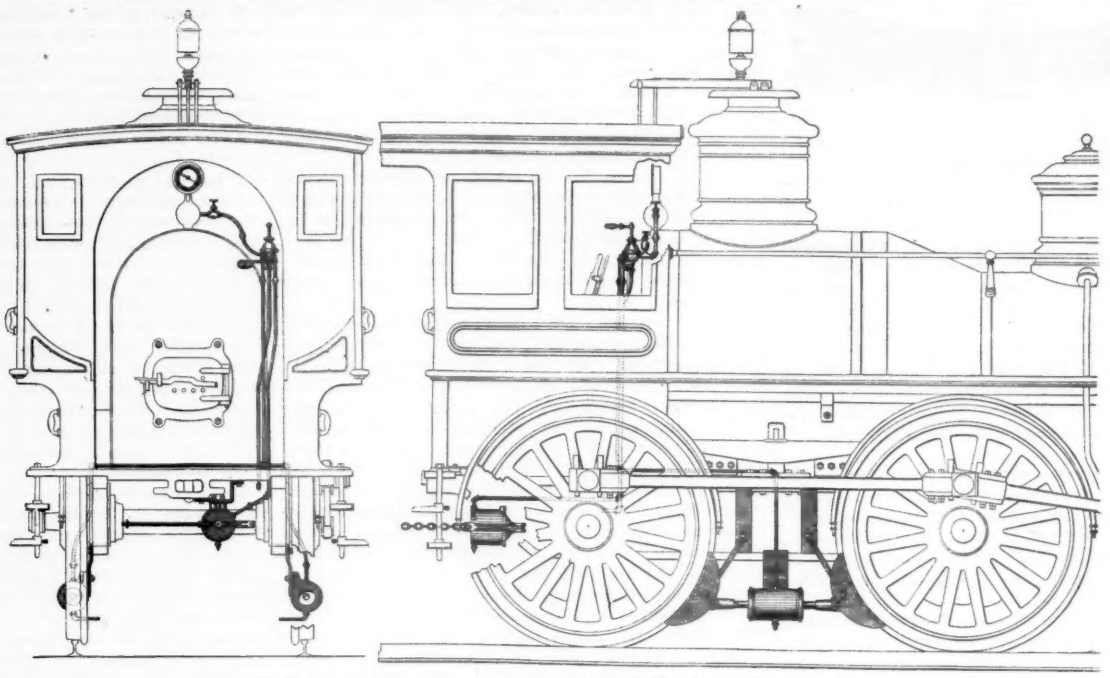


FIG. 1.—STEAM DRIVER AND TENDER BRAKE, AMERICAN BRAKE CO.

gines; second, a monthly report of work done by each engine; third, a quarterly report of the condition of driving-wheel brakes; fourth, a quarterly report on the condition of boilers; fifth, a quarterly report on the condition of air brakes; and sixth, a quarterly report on the condition of injectors. Blanks are furnished which must be filled out and signed by the inspector and master mechanic of the division. Mr. Cushing says: "You would hardly believe the benefit of these reports or the trouble in getting the system started." After getting used to it, however, the men charged with the work are so well pleased with the results that they would not like to abandon it.

The report on driving-wheel tires notes the amount worn off and the length of flat places, if there are any. When they are worn down to the limit of safety (before they are thin enough to be in danger of giving way), they are cast aside. In some of the reports the wear of $\frac{1}{64}$ in. noted.

The main object of these inspections is to discover and remedy defects before they become bad enough to cause a breaking down on the road. Accidents are thereby avoided. There are practically *no failures* of boilers on the Northern Pacific.

The inside of injectors, with some water used on this line, rapidly fill with a crusting of lime. In order to clean them readily, they are made in three sections and joined together, so as to be conveniently taken apart. Injectors have daily inspection with other parts of the engine, and at the close of the monthly examination in detail for purpose of the special report sent to the Superintendent of Motive Power. Every part must be examined and condition carefully noted.

These reports require special examination in detail at stated intervals. The usual daily inspection of locomotives is not taken as the basis of these reports. All these special reports are filed away in the office of the Superintendent of Motive Power, so as to be referred to at any moment.—*American Machinist*.

Power Brakes for Freight Trains.

Mr. William P. Shinn read before the American Society of Civil Engineers, at the annual convention, June 26, 1885, a paper under the above head which has but recently been published in the *Transactions* of the Society, and which gave the details of an elaborate experimental investigation of the actual capabilities of buffer brakes, as embodied in the only device of the kind as yet in general use, that of the American Brake Co. The investigations are embodied in full tables, and diagrams giving the records of a number of series of tests made under the auspices of the American Brake Co. with a train fitted out by it, and provided with suitable automatic recording apparatus.

The tour made by this train last season, while making tests in various parts of the country, will be still remembered, and the paper which records the results of these and other tests has no little interest at the present time, as a tolerably definite presentation of just what can be done with these brakes in their present form, and as such reflects much credit both upon the author and the company under whose auspices the tests were made. The paper is very voluminous, but it is fitting that the exact facts in extensive tests of this character should be put on record, especially when on a topic which is at the present time so justly engaging the attention of railroad men.

We shall, however, probably best consult the convenience of our readers by abbreviating the paper, analyzing the results obtained as carefully as possible, and presenting the net results obtained, in continuation of the discussion of the brake question which we began last year,* which was suspended for the time being, largely because of the proposed making of the very tests on which this paper is founded, as was stated at the time.

We precede the publication of the results embodied in the paper by extracting from it the description of the American Brake Co.'s apparatus, a clear understanding of which is important for interpreting the tests:

Fig. 1 illustrates one of several arrangements of the American Brake Company's steam-driver and tender brake. This arrangement is used where the space between the drivers is sufficient to admit of it, but where the drivers are too close for it, a vertical cylinder is substituted, and in some cases the application of the brake is made on the outside instead of the inside of the driving-wheels. There is a second cylinder under the foot-board of the engine, the piston of which is connected by a chain in the usual way with the brake-rods of the tender. This brake is brought into action by admitting steam to the cylinders at boiler pressure. The engineer's valve is of such construction that its first opening admits steam to the cylinder under the foot-board, thus applying the tender-brake first. A further movement of the valve admits steam to the cylinder of the driver-brake. It is claimed by the company that the arrangement of the driver-brake is such as to guard against the shocks produced upon the brakes by the inequalities of the track. The whole apparatus is certainly very simple, and there appears to be no reason why it should not be thoroughly effective.

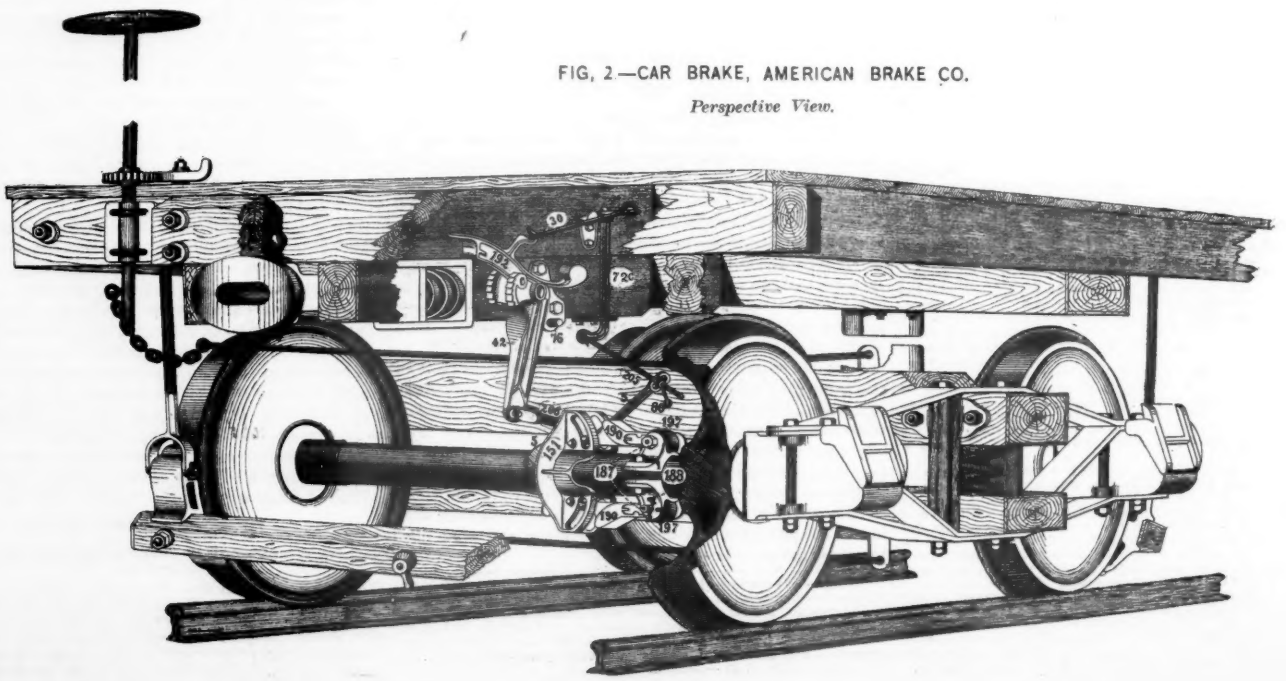
Fig. 2 gives an isometric view of the car brake-gear (which has since been modified). It is operated by the compression of the draw-bar. The motion of the engine being checked by application of the driver-brake or by encountering any obstruction, the momentum of the cars causing them to press more or less forcibly together. The essential features of the brake are as follows: The push-bar 192, when the car is at rest, is in the position shown in fig. 2, when any compression of the draw-bar will not affect it. The car can be pulled forward or backed at slow speed, without in any way acting upon the push-bar. The push-bar is connected with a lever 42, extending downward, at the lower end of which it takes hold of the pull-rod 206, which is connected with the brake-lever by the relief-spring 185. The push-bar and its right-angle lever 42 are so pivoted and connected that any pressure against the front of the push-bar, when it is in position to apply the brakes, will operate to force the lower end of the lever forward or toward the end of the car, thereby transferring the force by means of the pull-rod to the brake-lever, the remainder of the action being the same as when the power is applied to the brake-lever by hand.

The most essential feature of this brake is the apparatus upon the axle, which is designed to prevent it from coming into action when the car is being moved at a low rate of speed, or when it is to be backed, and to cause the brake to be released promptly when the stop is made. This apparatus

* "The Computation of the Efficiency of Brakes," *Railroad Gazette*, May 15, 1885. "The Maximum Efficiency Brakes," May 22, 29, 1885.

FIG. 2.—CAR BRAKE, AMERICAN BRAKE CO.

Perspective View.

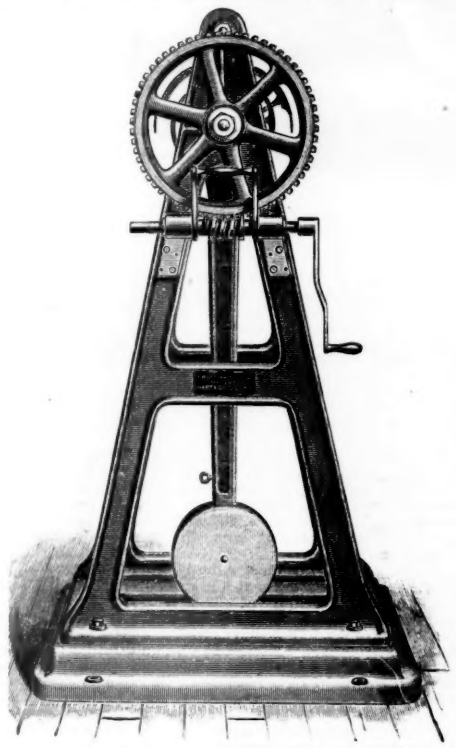


consists of the disk 151, which is suspended around but not attached to the axle. On the back of the disk are two flanges or plates, having two slots in each, in which the ends of the governor blocks 190 move outward and inward, by their motion causing the disk to be moved laterally on the axle. The governor blocks 190 are pivoted at their fastened ends to the axle clamp 1, the clamp being bolted securely to the axle. The governor blocks are held against the axle, when the car is at rest or moving at a slow rate of speed, by the volute springs 197. In front of the disk is the fork 5, which is suspended around the axle without touching it, and which is connected by the lower bell-crank rod 205, the bell-crank 72 *C* and the upper bell-crank rod 30 to a hook on the upper side of the push-bar.

When, by the rotation of the axle, the centrifugal force thus generated opens out the governor blocks 190, so that they draw toward themselves the disk 151, to which they are attached, and thus permit, by means of the fork 5 and rod connections 205 and 30, the push-bar to drop behind the draw bar.

When the axle ceases to revolve and the centrifugal force dies out, the governor blocks are forced back and held by the volute springs 197, and by means of the same fork and rod connections lift the push-bar up and out of engagement with the draw-bar, so that the car can be backed without applying the brakes. When the car is at speed and the push-bar consequently engaged behind the draw-bar, any compression of the latter, obtained by resistances offered at the head of the train, will necessarily apply the brakes by means of the forward movement of the lower end of the fulcrumed upright lever through its rod attachment to the end of the brake lever.

The weight of the governor blocks and the strength of the



Thurston's Autographic Torsion Testing Machine.

volute springs are so proportioned (or intended so to be) as to cause the blocks to remain against the axle till the speed of the car reaches six or eight miles per hour, when the centrifugal force of the governor blocks overcoming the pressure of the springs causes them to separate, withdrawing the disk from the fork and allowing the push-bar to drop behind the draw-bar if the car is being pulled; if the car is being pushed, the draw-bar will be compressed and the push-bar cannot drop behind it until, by checking the engine, the draw-bars will be momentarily drawn out, when the push-bar will come into position to apply the brakes.

The brake is illustrated as it was actually used in the tests. Since making them, however, the company has improved upon the brake in sundry minor particulars, notably in removing the relief spring from the pull-rod 206, and placing it at the back of the first brake-beam, so as to avoid lost motion. A dead-lever has also been introduced to equalize the pressure on the two brake-shoes.

That this apparatus will and does go through the motions of applying the brakes automatically, precisely when and as they are wanted, under all circumstances in the ordinary routine of operation is beyond question. The only question is as to the degree of efficiency realized from the brakes when applied, and in this respect also the tests seem to show a very creditable record.

Thurston's Autographic Torsion Testing Machine.

This machine has for its purpose the determination of the torsional strength of materials, producing an autographic record of the values of elasticity, ductility, resilience, homogeneity and ultimate resistance of the various metals, alloys and woods used in engineering construction.

The machine is capable of revealing characteristic properties upon which to base sound practical judgment as to their relative usefulness for the various purposes for which materials of construction may be required, and also under the different conditions of their production or manufacture.

Simple in construction and designed with special reference to rigidity and to convenience of operation, it provides improved methods of subjecting specimens to strains of torsion, either continuously or allowing periods of rest, the latter effect being to show remarkable powers of recuperation of strength in the specimen when apparently giving way under continuous twisting strain; while all the effects of strain may be observed to final rupture, the autographic record being presented graphically by a curve traced by the machine itself.

By the use of this automatic recording device the relation between the moment of torsion and the angle of torsion is represented graphically throughout the entire investigation.

Each jaw receiving the specimen has its axis in the same plane, horizontally and vertically, and motion given to the worm wheel is imported through the specimen to the weighted pendulum, which is hung on the opposite side of the frame. A yoke, carrying a pencil, is attached or pivoted to the pendulum, and is guided at its upper end by a brass semi-circular template, or "curve of sines," its inner edge being cut to represent a curve, the ordinates of which correspond to the torsional resistance of the weighted pendulum, while moving through an arc to which the corresponding abscissæ are proportional; while the rotation of the jaw attached to the worm wheel causes the pencil to be moved forward by the action of the guide curve upon the upper end of the pencil yoke.

Upon the shaft connecting the worm wheel and the jaws which receive the end of the specimen is a brass drum 5½ inches wide and having a circumference equal to 36 inches. Upon this drum is stretched a specially ruled blank of section paper, each square lengthwise representing one degree of arc. Upon this blank the strain diagram is autographically traced. The motion of the pencil in the direction of the axis measures the torsional moment, from which the tensile strength of the specimen may be deduced; while the rotation of the drum carrying the diagram represents the angle of torsion, from which is deduced the ductility of the specimen.

By an improved device the worm can be readily disengaged from the worm wheel, and by carefully allowing the pendulum to swing back to its normal position, either by hand or using the worm and wheel, the limit of elasticity may be determined.

A number of diagrams, representing strains or tests made of various metals or alloys can be placed upon the same sheet, affording an easy comparison of results.

It is a testing machine that should find a place in the laboratory of every scientific school where principles of strength of materials are taught, and if widely introduced into the iron-working and steel-making establishments of the country, would prove of invaluable assistance to the engineer in selecting the best materials of construction for every requirement.

This machine is manufactured by the Pratt & Whitney Co., of Hartford, Conn., from whom any further information may be obtained.

Thurston's Standard Railroad Oil Testing Machine.

This machine has been specially designed to provide means for reliable and systematic investigation of the value of the various lubricating oils used in railway service, and for all purposes for which it is essential to reduce to a minimum the friction of bearing surfaces under heavy pressures, securing economy in power required in overcoming this factor of resistance to motion, and determining the best, and consequently the *cheapest*, oils for lubricating purposes.

Additional advantages secured in this machine are those due to rigidity and careful fitting of the separate parts: while the whole machine is arranged with special reference to convenience of operation.

The journal, which is Master Car-Builders' Standard, 3¾ in. diameter, is a hardened steel sleeve, ground perfectly cylindrical. The boxes in which this journal runs are of phosphor bronze, and are designed for internal water circulation.

A late improvement includes a thin lining of phosphor bronze or other metal ordinarily used, which can be accurately weighed before and after a test, thus determining the percentage of wear for any given metal and mileage. The linings are made perfectly interchangeable, and can be renewed at any time, or special linings of any other metal or alloy may be inserted, using the same water brasses.

Pressures up to 9,000 pounds are obtained by the use of a heavy helical spring secured within a 4-in. wrought-iron pendulum tube. By a convenient taper-key adjustment (not shown in cut), the pressure may be easily and quickly relieved for removal of the pendulum and brasses, for inspection of the latter, or of the journal, without release of pressure of the spring within the tube.

The standard water brasses may be replaced by the ordinary brasses used in freight or passenger service if desired, giving actual conditions, in this respect, under which the test may be conducted.

Friction at the surface of the journal is indicated on a graduated arc, conveniently placed above the pendulum.

Friction between the surfaces of the journal and the brasses tends to rotate the heavy pendulum; hence to give as great a range as possible, and to enable the observer to note small changes of resistance, a form of compound pendulum is adopted, as shown in the illustration.

A standard thermometer, graduated 40°—350° Fahrenheit, and Centigrade to correspond, is inserted to indicate, as nearly as possible, the exact temperature of the surfaces in contact. A positive automatic revolution counter is attached, registering up to 1,000,000, affording ready means for determining the comparative mileage run during any investigation.

Speeds, corresponding to rates usual for train service, either freight or passenger, are obtained by the use of a counter shaft, being two pairs tight and loose pulleys, 10 in. diam., 6¼ in. face and 18 in. diam., 4⅝ in. face, respectively. A two-grade cone, 4¼ in. face, gives ample belt efficiency for the four speeds thus obtained.

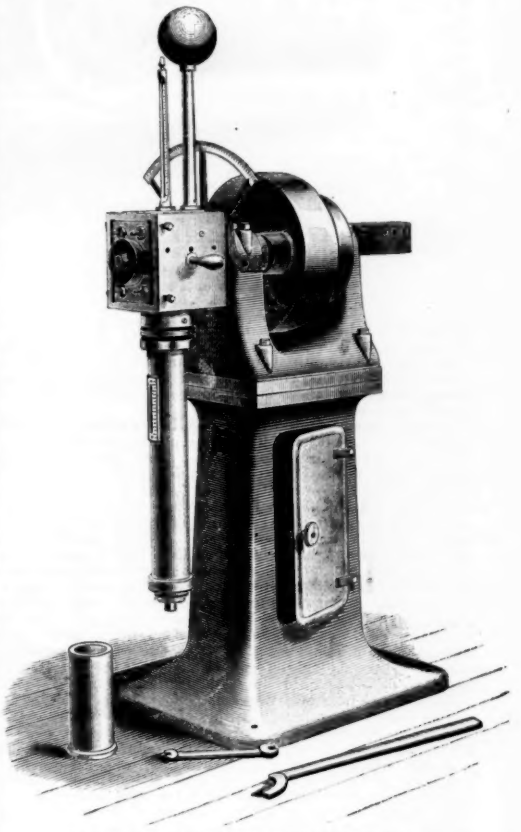
An extra journal sleeve of wrought axle iron, wrenches and counter shaft complete, furnished with each machine. Weight, including counter shaft, 1,125 lbs.

The Standard Railroad Oil Testing Machine is now made by the Pratt & Whitney Co., Hartford, Connecticut.

The Effect of Blue Heat on Steel and Iron.

The following is a synopsis of an important paper on the above subject, read before the Institution of Civil Engineers, by C. E. Stromeyer, Assoc. M. Inst. C. E.

Many engineers considered mild steel a treacherous material, as steel plates and bars often failed, in their opinion, in an unaccountable manner. In nearly all such cases the plates had been subjected to bending or hammering while at a blue or black heat. The expression "blue heat" included all those temperatures which produced discolorations (ranging from light straw to blue) of the surfaces of bright steel or of iron. Such treatment was the most injurious to which steel could possibly be subjected, and, therefore, such failures could not be regarded as unaccountable. Iron possessed the same peculiarity, but being less ductile than steel, similar features were not so glaring. Plates, both of iron and of steel, had failed without this treatment, although the quality of the material was good, according to



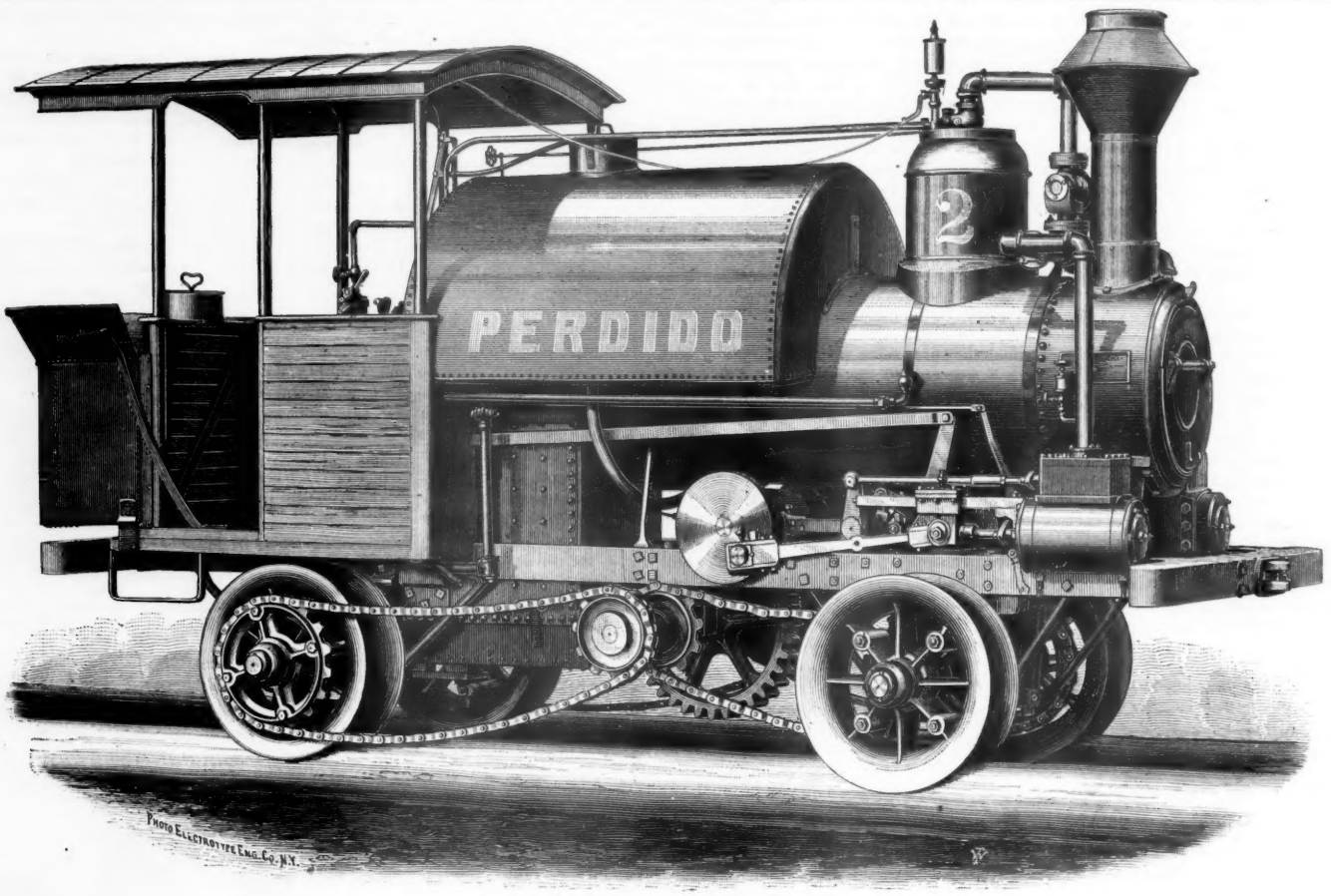
Thurston's Standard Oil Testing Machine.

the usual tests. Three hundred and thirty experiments had been made in connection with the subject of the paper, and consisted mainly of bending and of tension tests. The results were contained in tables and in diagrams. The limit of elasticity of both iron and steel was raised by repeated tension-testing. In some cases the limit rose above the original breaking-stress, although the ultimate breaking-stress was only slightly affected. The total elongation was reduced by previous mechanical operations, while the contraction varied considerably. A test-piece which had been shortened when cold showed a reduction of the elastic limit, but another piece which had been shortened when hot showed an increase.

Steel which had been bent cold, either once or twice, would stand almost as many subsequent bends as the original test-pieces. But if the same material was bent once while blue-hot, it lost a great deal of its ductility. Out of twelve samples, in which two preliminary hot bends were made, nine broke with a single blow of a hammer, and the other three only stood one or two subsequent bends. Thin Lowmoor iron did not break quite so easily, but supported about one-half the original number of bends. The following table showed the number of bends before breaking:

	Medium hard steel. ⅝ inch.....	Mild steel. ⅝ inch.	Very mild steel. ⅝ inch.....	Lowmoor iron. $\frac{3}{16}$ inch.....
Unprepared or annealed..	21	12½	26	20
Broken hot (blue)	2½	1⅓	2½	3
1 preliminary hot bend...	3 mean	2⅓ mean	11 mean	11 mean
2 " " bends..	½ "	⅓ "	¾ "	10 "
1 preliminary cold bend..	20	9⅓	..	..
2 " " bends..	19½	8⅓	19	13
4 " " " ..	..	..	13	11
8 " " " " ..	..	..	15	6

The experiments all pointed unmistakably to the great danger incurred if iron or steel were worked at a blue heat.



POLE ROAD LOCOMOTIVE.
Built by ADAMS & PRICE, *Nashville, Tenn.*.

The difference between good iron and mild steel seemed to be that iron broke more readily than steel while being bent; that iron suffered more permanent injury than steel by cold working, but that if it had successfully withstood bending when hot, there was little probability of its flying to pieces when cold, like mild steel.

It was a common practice among boiler-makers to "take the chill out of a plate" if it required a little setting, or to set a flanged plate before it was cold. This was nothing else than working it blue hot, and should not be allowed. All hammering or bending of iron and steel should be avoided, unless they were either cold or red hot. Where this was impossible, and where the plate or bar had not broken while blue hot, it should be subsequently annealed. It was satisfactory to learn that, since the introduction of mild steel, a practice had been gaining ground among boilermakers which must have the effect of guarding against such failures, and should be encouraged. It consisted in the cessation of work as soon as a plate, which had been red hot, became so cool that the mark produced by rubbing a hammer-handle or other piece of wood over it would not glow. A plate which was not hot enough to produce this effect, yet too hot to be touched by hand, was most probably blue hot, and should under no circumstances be hammered or bent.

The theory that local heating of a plate set up strains which sometimes cause failures did not appear to be supported by the experiments. But it was doubtful whether the proposal to locally reheat a plate which had been worked when hot, in order to anneal this part, should be carried out. Several test-pieces were made red hot or blue hot, and then were slowly cooled by holding one of their edges in cold water. As might have been expected, the medium hard steel lost much of its ductility. The other steels and the iron were not greatly affected, the following table showing the number of bends before breaking:

	Medium hard steel.	Mild steel.	Very mild steel.	Lowmoor iron.
Unprepared or annealed.	21	12½	26	20
Quenched red hot in boiling water.....	24	10	..	..
Quenched red hot in cold water.....	1	10	19	20
Red hot, quenched edge in cold water.....	3	8	25	27
Blue hot, quenched edge in cold water.....	3	6½	19, 19	21, 14

Steel manufacturers should endeavor to ascertain whether every quality of steel was made permanently brittle by being worked at a blue heat, or whether this was independent of the various impurities contained in it; and also whether prolonged exposure to a blue heat could produce the same effect.

Pole Road Locomotive.

The accompanying illustration represents a logging locomotive built by the Adams & Price Locomotive & Machine Works, Nashville, Tenn. The engine is specially adapted to run on a pole road, the tread of the wheels being curved for this purpose, as shown in the illustration. The "Perdido" was finished in November, 1885, and was immediately put to work at Wallace, Sandford & Co.'s mill at Wilson's Station, Ala. She pulls seven cars with three to four logs on each car, with an average of 120 cubic feet per car load. The road is constructed of pine poles, 30 ft. long and from 8 in. to 12 in. diameter, laid 5 ft. from centre to centre of poles. No cross ties are used. The joints are made with a lap, as shown in the accompanying cut, the small end being laid on the lap of the larger end, and pinned with a 2 in. pin made of any suitable wood for the purpose.

The carrying wheels (four in number) are sheave-shaped, and have a lateral play on their axles, which are stationary, so far as revolving is concerned, but are free to work up and

Pole Road Joint.

down in pedestals. Spring seats and springs are provided, and the engines ride remarkably easy considering the material of which the track is made.

The cylinders are 7 in. by 12 in. The engine shaft carries a 10 in. pinion, with 6 in. face. This pinion runs into a 30 in. spur wheel on the master shaft, which is provided with sprocket wheels which are two-thirds the size of those on the carrying or driving wheels, which are 24 in. diameter. The chain used is a steel roller chain, made by the Lechner Co., of Columbus, Ohio. Each carrying wheel is driven separately. The valve gear is of the shifting link type. The valves have 2¼ in. travel, 1/8 in. lap, 3/32 in. lead, at full gear, and 1/8 in. inside lap. The steam ports are 5/8 in. by 6 in.; exhaust port, 2 in. by 6 in.; water tank capacity, 550 gallons. The fuel used is pine.

The makers inform us that the "Escambia" (a similar engine to the "Perdido") is at work on a pole road belonging to C. S. Lowell & Co., of Wallace, Ala., and pulls a train over grades of 200 feet to the mile.

As the engines are geared 4½ to 1 they are very powerful, but do not run over five miles per hour. Messrs. Adams & Price are about to build some engines with 9 in. by 16 in. cylinders and 36 in. drivers geared 3 to 1. These dimensions give a tractive force of 108 lbs. per lb. average pressure on the pistons. These engines will have six driving wheels, and are calculated to run at 12 miles per hour. The wheels will be fast on the axles, which will revolve. The chain gear will be of an improved form and will work wholly inside the frame. These engines will have plate frames similar to those used in Great Britain and Europe generally. These locomotives will be built for a combination track, wood and iron, and will be able to run on poles, square timbers or ordinary rails.

Relation of Roadway to Rolling Stock.

The last meeting of the New England Railroad Club, Feb. 10, 1886, was a joint one with the Boston Society of Civil Engineers, at which a list of 24 contrasted topics under the general head above, given in our issue of Jan. 22, 1886, was up for discussion. As might have been expected, it proved impossible in one evening to more than begin the consideration of the great questions covered by the programme, and after a discussion, chiefly confined to the question of gauge, it was voted to continue the subject over other joint meetings.

President MARDEN, of the New England Railroad Club and Vice-President RICE, of the Boston Society of Civil Engineers, presided jointly. There was a large attendance.

A committee of three to nominate officers for the ensuing year, consisting of Messrs. Richards (Boston & Providence), J. Chamberlain (Boston & Albany) and John Kent having been appointed, President MARDEN opened the discussion, declaring that it gave a special interest to the meeting to have both track and rolling-stock represented, but that, in his opinion, the road-bed should come first and rolling stock should be adapted thereto. He greatly regretted that Mr. M. N. Forney could not be present to open the meeting, as had been hoped.

Mr. BISSELL (Eastern) regretted Mr. Forney's absence. He thought his ideas of the form of wheel treads were very good, but believed in a smaller radius for the corners of rails.

Mr. HARDY (Boston & Albany) read a letter from Mr. Forney expressing inability to attend, and offered a resolution that "the present wheel gauge is altogether insufficient." After some discussion as to what was the precise meaning of the resolution, the vote was put with about an equal number of ayes and noes, and was not pressed to a decision.

Messrs. ADAMS (Boston & Albany) and LAUDER (Old Colony) then discussed the next question, on the cause of sharp flanges. The percentage of wheels removed for it is very slight, and it seems to be chiefly due to faults of car construction. The trucks do not curve readily, are diamond shaped, have wheels not well matched in size, and similar defects.

Mr. LAUDER thought it was a fact that there were more sharp flanges on straight roads than on crooked roads, and thought the nature of the truck defects made this reasonable.

Mr. BIDWELL (Chief Engineer New York & New England) read a memorandum on the question of rails and wheels. He did not think it advisable that the corner of rails and wheels should coincide in radius. The subject of curving was still very little understood. It was all but useless to cone wheels, as was shown by Mr. Forney's interesting experiments in 1884, unless the axles could be made to radiate, and enough play for this purpose could not be allowed even if it would be effective.

Mr. ADAMS hoped the question of gauge would not be lost sight of. The Pennsylvania road, with 4 ft. 9 in. gauge, accepted wheels with 4 ft. 5 in. and 5 ft. 4 in. inside and outside gauges, but preferred 4 ft. 5⅝ inside, as per Master Car-Builders' standard. Statistics gathered by Mr. Opdyke (Superintendent New Haven & Northampton) showed (as per table herewith) that the standards of New England roads varied from 4 ft. 5 in. to 4 ft. 5½ in. inside gauge of wheels.

Mr. OPDYKE had collected the figures largely to study their bearing in the use of Wharton switches. Most of the present wheels were very nearly equal in total thickness, but in how much of it was flange and how much tread they varied considerably.

Mr. HARDY found that such variations made it bad business keeping up frogs and guard-rails, and others followed to the same effect.

Mr. ADAMS pointed out that until recently New England wheel-makers supplied wheels 1/16 in. less in tread than west of the Hudson River. He had adopted the defeated standard tread, having a cylindrical central portion and a sharp coning outside. He did this, not as satisfied that it was the best, but because he wanted something definite, and thought its faults were not serious.

Considerable discussion then ensued as to whether this would or would not be injurious to frogs.

Mr. LAUDER thought it would, and he had observed its detrimental effect on the Old Colony, especially on the White switches. Others thought not, or at least that the difference would not be noticeable. Nothing particularly definite or decisive in the way of absolute results was brought forward.

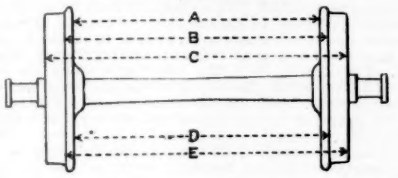
Mr. BLACKALL thought that guard-rails should be set 2 in. off, whatever spread was given to the rails. They found that rule to work well. The West Shore had many narrow-tread wheels. They were rejecting many less than 4 ft. 5 in. inside, or over 5 ft. 4 in. outside.

Mr. THOMAS DOANE believed it very important to allow plenty of extra play in curves, with close gauge on straight lines. He had used as much as 3/4 in. on 3-degree curves in Nebraska, and he thought experience had shown to great advantage. He thought there was plain necessity, because the truck gets cornerwise on curves, especially if sharp. He thought opinion was tending that way.

Mr. WELLINGTON said that, as a matter of fact, there ap

WHEEL-GAUGE PRACTICE OF NEW ENGLAND ROADS AND CONNECTIONS.

Gathered by S. B. Opdyke, Superintendent New Haven & Northampton Railroad.



Name of Railroad	Shop rules for fitting wheels. Standard gauge between flanges. A	Shop rules for fitting wheels. Wheel gauge..... B	Shop rules for fitting wheels. Out to out of treads..... C	Inspectors' rules for receiving wheels. Minimum gauge between flanges. A	Inspectors' rules for receiving wheels. Maximum wheel gauge..... B	Inspectors' rules for receiving wheels. Minimum distance out to out of treads..... C	Inspectors' rules for receiving wheels. Track gauge.....
	Ft.in.	Ft.in.	Ft. in	Ft.in.	Ft.in.	Ft in	Ft.in.
M. C. B. Standard...	4 5⅜	.....	(5 4⅜)	4 5¼	.....	(5 4⅜)	4 8½
Boston & Albany..	4 5⅜	4 7⅛	5 4⅝	4 5	4 8	5 4	" "
" Hoos. T.&W	4 5	4 7⅛	5 4	4 5⅜	4 8¼	5 3⅝	" "
Conn. River.....	4 5¼	4 8¼	5 4	.....	.....	.....	" "
Fitchburg	4 5⅜	.....	.....	4 5*	.....	.....	" "
Hartford & C. V....	4 5¼	4 8¼	5 4¼	4 5	4 8¼	5 3	" "
New Haven & Derby	.....	.....	.....	.....	.....	.....	" "
New Haven & Northb.	4 5⅜	4 7⅛	5 4⅜	4 5	4 8¼	5 4	" "
N. Y & N. E.....	" "	4 8⅛	" "	4 5	4 8¾	5 4	4 8¾
N. Y. Cen. & H. R....	" "	4 7⅞	" "	4 5¼	4 8	.....	4 8½
N Y., L. E. & W	.....	.....	.....	.....	.....	.....	.....
N. Y., N. H. & H...	4 5¼	4 7⅞	5 4¼	.....	.....	.....	4 8½
Pennsylvania.	4 5½	4 8¼	5 5¾	4 5	4 8¾	5 4	4 9
Troy & Boston	4 5⅜	.....	.....	.....	.....	.....	.....

* Maximum 4 ft. 5⅜ in.

Name of Railroad.	Thickness of flanges.	Width of tread.....	Total width of wheel.	Inside of flange to opposite point of D	Gauge point of one wheel to out of tread of opposite wheel ..... E	Theoretical distance for guard rail track, gauge 4 ft. 8½ in..
	In.	In.	In.	Ft. in.	Ft. in.	In.
M. C. B. Standard...	...	....	(5½)	.....	.....	.....
Boston & Albany.....	1¼	4¼	5½	4 6⅝	5 0⅛	1⅝
B. H. T. & W.....	1 1/16	4 1/16	5½	4 6 7/16	4 11 5/16	2 1/16
Conn River.....	1⅜	3⅛	5¼	4 6⅛	5 0⅛	1⅝
Fitchburg.....	...	...	.....	.....	.....	...
Hartford & Conn. W.	1½	4	5½	4 6¾	5 0¼	1¾
New Haven & Derby.	....	....	.....	.....	.....	.....
New Haven & North..	1¼	4¼	5½	4 6⅝	5 0⅛	1⅝
N. Y. & N. E.....	1⅜	4⅛	5½	4 6¾	5 0¼	1¾
N. Y. Cen. & H. R...	1¼	4¼	5½	4 6⅝	5 0⅜	1⅝
N. Y., L. E. & W....	....	....	.....	.....	.....	.....
N. Y., N. H. & H....	1 5/16	4 3/16	5½	4 6 11/16	5 0 1/16	1 13/16
Pennsylvania.....	1⅛	4¾	6⅛	4 6⅛	5 1	1⅜

The figures in (parentheses) are what would have been the M. C. B. standard had the proposed standard wheel-tread been adopted.

peared to be rather a plain tendency in the other direction—to omit all widening of gauge of any kind. The Union, the Central and the Northern Pacific and a number of other prominent Western lines were doing so with the Pennsylvania, Baltimore & Ohio, and others in the East. One reason probably was that wear of outer rail widened the gauge a good deal any way, and to an injurious extent the gauge was made wide in the first place. It did not appear to be true, moreover, that trucks got cornerwise between the rails, if the wear of rails was any evidence. The outside rail on curves is invariably flange-worn on the side, but the inside, though often losing more in weight, was always worn flat on top, with no evidence whatever of inside flange-wear.

Mr. W. F. ELLIS (Providence & Worcester) presented their present standard 72-lb. rail, which had been adopted, with some modifications, from designs of Mr. M. N. Forney, and made a careful exposition of its various points, illustrated by templates of new and old wheel-treads. It had a ½-in. corner radius, 20-degree fish-plate angle, 2⅝-in. width at top of head and 2¼ at bottom (so that the sides sloped inward). It had been rolled by the Troy Steel Co., which objected to the large curve at the corner, but finally acceded to it. So far the rail was giving very excellent satisfaction. Its extreme dimensions were 4¾ × 4¾ in. He had no belief that there was any advantage in widening tracks on curves. It did not prevent crowding over the inner rail, however wide it was. He had known a curve of 24 degrees to be laid ¾ in. wide, and in a very short time it had spread so as to be 2 in. wide of gauge, while the same curve laid to 4 ft. 8½ in. stood much better.

Another instance at South Boston was then mentioned, where a curve of 78 ft. radius, run over by a switch engine having a 7 ft. 6 in. wheel base and weighing 44,000 lbs., was laid to snug gauge, and in 2½ years had only widened out to 4 ft. 9 in.

Mr. OLIVER then gave some interesting reminiscences of the use of very sharp curves in the Lowell and Lawrence mill yards. Curves of 60, 80 and 120 ft. radius had been used in many places to tight gauge, and given no trouble from spreading.

Mr. ADAMS said it was clear the sense of the meeting was against using wider gauge on curves. It was like the question of longer wheel-bases. A few years ago railroad men looked on it as fixed that the wheel-base must not be longer than the gauge. Now they were over twice as long in passenger service, and within certain limits the longer the better.

Mr. MARDEN said the proposed action of the Southern roads in narrowing their gauge to 4 ft. 9 in. made the question particularly timely, and he hoped the discussion would be continued to other evenings. The fact that the Southern roads were adopting a 4 ft. 9 in. standard made it increasingly important to settle on definite standards.

Mr. WELLINGTON doubted if the purpose expressed to adopt 4 ft. 9 in. as a standard Southern gauge would be adhered to, or certainly not as a permanency. It was difficult to see anything to be gained thereby, while the disadvantages of a half-inch break of gauge were considerable. The Pennsylvania was the only Northern system using it, and it was forced on them in the early railroad days as a compromise with 4 ft. 10 in. gauges.

Mr. ADAMS suggested that the extra half-inch might have been of importance for some of the fire-boxes, although most of the newer engines had been expressly adapted for the change.

A letter from C. A. Smith (Union Tank line) was presented, containing the following:

"Causes of sharp flanges are: Wheels not of same diameter; wheels not pressed on axle same distances from centres of journals; centres of axles not same distance apart, or axles not parallel; side bearings take the weight instead of centre-plate; wheel treads not of same shape. This latter cause has, I think, been thought of too little consequence.

"Wheels are centred only by wheel-boring machine and mated by a steel tape.

"We have many cars running with about three-fifths the load of the heaviest, and the greatest capacity cars run as safely as the smallest; possibly there may be more wear on wheels under 20-ton cars than under 10-ton cars, but the difference, if any, is so small that it has not been located as to its effect.

"If middle trucks are advisable, I would recommend that they be secured to the centre of the car under body, so that the wheels never touch the rails, making a good ballast to keep the car from tipping over."

Mr. COLEMAN closed the discussion with some remarks on the badness and roughness of car construction, and the losses resulting therefrom, and Mr. DOANE exhibited a proposed composite rail, consisting of three parallel pieces, and weighing in the aggregate 92 lbs. per yard. It was then voted that the presidents of the two organizations represented arrange for further joint discussions of the same topics, and the meeting adjourned at a late hour.

Rail-joints and Steel Rails.

[Paper read before the British Institution of Civil Engineers by Mr. C. P. Sandberg.]

(*Continued from page* 109.)

PART II.—THE WEAR OF RAILS.

The second item in the news from America is that steel rails wear badly, so that some are worn out in a very short time. In the spring of this year the *Railroad Gazette* contained an article on the wear of steel rails, in which it was stated that the result of wear on some American lines had been rather indifferent, and that a commission had been sent to Europe to inquire whether there was any reason for believing that English rails were superior to those made in America. Their conclusion, in short, was that good and bad steel rails could be made, and were made in Europe as well as in America; and that it rested with the railways themselves to protect their own interests. The following are the errors they indicated:

If certain railways bought the cheapest possible rails after jobbing in the market without choosing a good maker; or if they applied no specification, inspection, or supervision of the manufacture, or did not test the rails, either for wearing qualifications or for safety, they naturally must have taken for granted that all steel rails were equally good or bad, and they had to pay for gaining experience.

If, above all, they overloaded their rails with too heavy rolling stock, or used a 50-lb. rail, of perhaps a poor section, where they really should have used a 60-lb. or 70-lb. rail, they made the mistake of trusting too much to the small abrasion of steel as compared with iron, particularly as they had to make it very soft so as not to break.

But any railway that took proper care of its interest in choosing a good maker, and having a good specification with careful, honest inspection, and a sufficiently heavy section, could have rails which gave good results, whether they were made in America or in Europe. On the whole, the experience in Europe of the wear of steel rails is good; but then the errors noted are generally avoided.

However, one of the leading railway presidents in the United States followed the best of all tests—experience. He had had excellent experience of the rails he had obtained about 18 years ago through a certain firm in England, and he did not hesitate to order 10,000 tons of similar rails through the same channel, although it will cost $100,000 more than if the rails were made in America. Being intrusted with the inspection of these rails, the author will take care that the honor of the English makers is maintained.

CHEMICAL COMPOSITION OF RAIL-STEEL.

Through these results of the wear of the rails in America the question of the chemical composition of rail-steel comes again to the front. To show that pure steel may not always gives satisfactory results in wear, the author had a few steel rails made of the purest raw materials, for trial on an English railway with heavy traffic, and the result was that they barely came up to the ordinary English steel rail in wear, because they were too soft. They contain about 0.3 per cent. of carbon and hardly any other hardeners. Of course the rail-steel can be made harder without any risk of breaking, if the material is almost free from phosphorus and silicon. The experience cited above is, however, a proof that even with the purest steel the soft rail does not come up to the hard rail in resistance in wear, contrary to what Dr. Dudley, the Chemist of the Pennsylvania Railroad, and others have advocated. Even in Sweden, which possesses magnificent deposits of pure iron ores, well adapted to the purpose of steel-making, the manufacture of steel rails has not been largely developed. This is due to the circumstance that Sweden does not possess coal suitable for the iron manufacture; the only fuel used for this purpose is charcoal, and this would make rails so dear that a protective duty of 30 per cent. would be required to make it pay. This duty the state will not grant, but prefers to have cheaper railways and plenty of them, laid with imported rails. There are now more than 4,000 miles opened, which is a higher proportion taken per head of the population than in any other country in the world. It may be added that the Swedish railways have, on the whole, yielded financial results which are satisfactory; and from a technical point of view the author can affirm that no country with a severe climate can show equally good results whether as to wear or to absence of breakages.

A steel with 0.3 per cent. of carbon where phosphorus and silicon are low, would surely give a rail too soft for wear, and the carbon may then well be increased to 0.5. But if the phosphorus reaches 0.1, then it is not safe to exceed 0.3 of carbon, particularly in cold countries. As to the silicon, so small a proportion as 0.04 per cent., as Dr. Dudley prescribes, is in the author's opinion a source of blisters and unsound ingots as well as of many wasters in rolling. With 0.1 per cent. of silicon, the steel is more quiet and solid in casting, and the rails are equally strong for the falling test, and certainly better for wear.

As rail-steel in one district may vary very much in chemical composition from that in another, and still good rails may be made in both, it would be unpractical to stipulate in the specification for only one definite composition. Nor is it wise to specify the amount of carbon only, because this should depend upon the amount of the other hardeners present. All that can be said is that rail-steel with carbon as the principal hardener and with a minimum of phosphorus is preferable, particularly in cold countries, and that the inspecting engineer should compare mechanical tests with the chemical composition of his rail and try to find what hardness can safely be used in each individual case. For there is no doubt that the rail of medium hardness wears better than that of soft or mild steel, however useful the latter may be for ship plates and for constructive purposes.

TESTS FOR STEEL RAILS.

Why should a steel rail require a heavier falling test than an iron rail is a question that makers were in the habit of asking engineers when steel-rail making was begun. The reply was, Because of the irregularity of the rail-steel, which was sometimes hard and sometimes soft, as proved by the frequent breaking of steel rails on the road. This was at the commencement of steel-rail manufacture some 15 years ago, and so the barbarous test of a ton falling 30 ft. was introduced.

The effect of this was the production of soft rail steel which would stand such a barbarous test, but the rails thus made now begin to show less durability in wear than the harder rails which were first made and subjected to lighter tests.

During the last 10 years, however, makers have greatly increased the probabilities of uniform production. The author observed this in 1881 both in England and in Germany when inspecting 100,000 tons of steel blooms for rails to be rolled out in America, and a definite chemical composition had to be adhered to. In fact, regularity of production is now generally obtained except with some new makers, who naturally cannot have the same experience as that acquired by old and long established firms.

It is really astonishing to note the regularity of production of Bessemer steel, and the only hardener which varies according to the heat of the blow is silicon. Bessemer steel is now made for tin-plate works and for ship-plates with an exceedingly small limit of carbon. The time has therefore come when railway engineers may better depend upon the regularity of production of their rails, and it is almost proved by practice on a large scale that the best wearing rail is one of medium hardness with, say, 0.5 per cent. of carbon, provided that the other hardeners, such as phosphorus and silicon, are at a minimum. I think engineers would do well to reduce the so-called barbarous falling tests to such as would enable makers to produce a somewhat harder rail than is now made, but still complying with perfect safety from breakage. The factors causing breakage are high speed, overloading of too heavy rolling stock, bad roads and cold climate and an overschemed rail section. The engineer knowing that he has got on his road any of these elements of danger in excess of the ordinary state of things must continue to keep his falling tests high, but then he must make up his mind to have a soft rail, from which he has no right to expect a maximum of wear. This is, however, no reason why the gross bulk of rails subjected to use on ordinary good railways under normal conditions should not now be made a little harder so as to give better wearing results, since more regularity of production can be depended upon. The suggestion is therefore made that the falling tests should be regulated according to the weight of the rail, as shown in the table appended to this paper, always bearing in mind that the rule is applicable only under ordinary circumstances.

The dead-weight tests should remain as severe as they are, but no maximum of deflection be stipulated, beyond that of each rail carrying a certain weight without permanent deflection. Of course, the section has a great deal to do with the results. The higher the rail-section the stiffer it is for the dead-weight test, but the sooner it will break under the falling test.

OVERSCHEMED RAIL-SECTIONS.

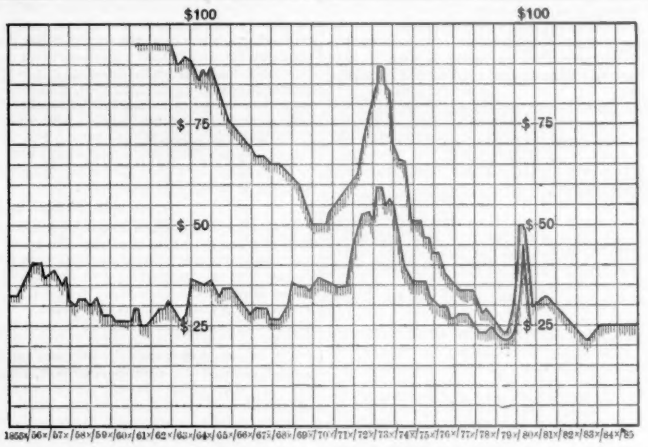
Some engineers have of late increased the height of their rail-section, keeping the weight the same, guided by the theoretical formula that the stiffness is in proportion to the square of the height. This would be correct enough if the rail were a girder subjected to permanent dead weight only; but as the rail is subjected to blows or concussions as well as to abrasion, there is a practical limit to the saving of material in this way. Take, for instance, an overschemed rail-section say with half the substance in the head, one-quarter in a thin web of great height, and one-quarter of the substance in a wide and thin flange. With the modern quick-running rail-mills, now established, such a section can well be rolled, but the widely different proportions of the section will cause the flange to come out at much lower heat than the head as compared with the author's standard section, in which the equal division is based upon ⅓ in the head, ⅓ in the web and ⅓ in the flange. Not only is the latter easier to roll, but it leaves the rolls at a more even heat in the different parts. The former rail-section will, in cooling, have a strain which will always remain in it, through the irregular cooling of the flange and the head; and this all the more as the steel is hard. With the ill-proportioned division of the material, the rails will in cooling draw very crooked, and require a great deal of rough mechanical treatment in cold-straightening under presses, which is often a source of fracture. The author's inspection books generally show rejection of no less than 7 per cent. of crooked rails. Thus, the form of the modern overschemed section will in itself be an element of danger, through having a strain in it which will tend to cause breakage with a comparatively light blow from, say, a heavy engine with high speed, a sunken sleeper, or a cold climate.

As an instance of unduly saving the material in this manner, a case may be cited of a railway which, when constructed twenty-five years ago, was laid with 63-lb. iron rails; the weight of the engine was then 27 tons, and the speed comparatively low. Since then the engine has gradually been increased to 37 tons, while the speed is 50 per cent. greater, and the weight of the carriages more than doubled. Nevertheless, 63-lb. rails are still used, but of steel, and of a section much deeper than the original iron-rail section. In order to guard against breakage of rails in such a case the use of heavy falling-tests and of a soft steel is necessitated, but the wearing qualities of the rails must naturally be sacrificed. The introduction of modern rolling-mills has certainly enabled railway engineers to design more economical rail-sections than in former days, but to go on increasing the height while keeping the weight the same in order to meet the demand of increased traffic and produce a stiffer rail, can only result in a source of danger.

The designer of a new rail-section should first of all think whether it can be easily rolled; but it often happens that he has never seen a rail rolled! And hence the great number of bad sections in the market.

WEARING RESULTS OF MODERN STEEL RAILS.

In a communication to this Institution "On the Manufacture and Wear of Rails," in 1868, an animated discussion was raised, which occupied five evenings, and led to the conclusion that steel rails, as far as experience had then gone, would last nine times as long as iron rails. What would be the opinion now? It is doubtful whether the experience now at command would not bear out this comparison; and this for two reasons: First, the steel rails have been made softer than they were then; and, secondly, there is a great deal



(The upper line represents steel rails, the lower iron.)

Diagram of Average English Prices of Iron and Steel Rails, 1855–1885.

more work put on them without an increase in the weight of rail. If steel rails made nowadays will endure three times as much wear as iron rails, this is as much as, generally speaking, can be expected from them. One high authority even calculates steel rails to be but slightly more durable than iron rails. The only country whose railways have been modified in accordance with altered circumstances is England.

THE WEIGHT OF STEEL RAILS FOR RENEWALS ON ROADS WITH HEAVY TRAFFIC.

In effecting the change from iron rails to steel, the English engineers increased the weight of rails, say, 20 per cent., because they could foresee the heavier work on the road in future, and they got their rails cheaper year by year till the cost of steel was below that of iron rails (see the diagram of rail-prices from 1855 up to the present time). The Continental engineers, on the contrary, reduced the weight of the steel rail 20 per cent. in order to compensate for the higher price of steel at the commencement, and since then they have increased the depth of section instead of the weight of rail. The result is that while in England the principal lines are now completely laid with rails of at least 80 lbs. weight per yard, and have chairs which offer a base at least 12 in. in width, the Continental lines have mostly kept to their 60-lb. flange-rails, with a base of, say, 4 in. and no chairs. How, then, could the results be expected to be the same on the Continent as in England? Allowing, say, one-quarter of the weight of the flange-rail for the flange, instead of chairs as used in England, the Continental railways should require a rail of 100 lbs. per yard to correspond to the English 80 lbs., and still the width of base would not be more than half that of the chair. The Metropolitan rail-section weighs 92 lbs. per yard, besides the chairs, but it is so rare to hear of a heavy flange-rail section, that only a short time ago the heaviest flange-rail section in America, of 82 lbs. per yard, was published in the *Railroad Gazette* as a monster.

In instituting a comparison between the cost of the English railways and that of a line laid with flange rails, there must be added, in the former case, the value of the chairs; the value of the rails, sleepers, fish-plates, and bolts being the same in both cases. Taking the weight of each chair at 40 lbs., and the cost of the chair at half that of the steel rails per ton, and one chair being used per yard of rail, it follows that we must add the cost of 20 lbs. of steel per yard to the cost of the English rail, thus making its value equal to that of a flange rail of 100 lbs. per yard. Again, comparing the work done on the English railways with that on some of the lines on the Continent and in America laid with flange rails, it will be found that the average speed is certainly greater in England; but then it must be remembered that there are often steeper gradients on the lines laid with flange rails, and thus in many localities the speed, though less uniform, becomes quite equal to that in England. The engines on the Continental lines are often heavier than those in England, and the work to which the rails are subjected is, therefore, often quite as heavy as in this country.

Have, then the English engineers been using unnecessarily heavy rails, or have the Continental engineers being laying down rails that are too light? There can be no doubt as to which of the two have been in error, whether regarded from the point of view of safety or of economy. Since the introduction of steel rails in England, derailment has diminished enormously, and the cost of repairs to the permanent way and rolling-stock has much decreased; while the comfort in traveling is greater than in any other country. As the value of time becomes more appreciated by Continental travelers, and as the arrangements for international through traffic —with heavy rolling-stock, such as sleeping and dining cars— become more general, the time must soon arrive when the 60-lb rail will prove too weak, at least on the main lines, and the necessity of replacing it by a stronger rail will soon become urgent. This exchange of rails will take a considerable time—perhaps 10 years—before it can be completely carried out. In the mean time traffic will go on continually increasing, and also the speed; for statistics show that on some lines the weight of trains has actually been doubled in 10 years. If, then, in making the change from the present 60-lb. rail, a 70 or 80-lb. rail is chosen, this will be found, by the time the substitution is completed, to be, like the former rail, much too weak. It will, therefore, in many localities, be wisest to take the full step at once, and boldly adopt a rail of 90 or even 100-lb. section. Of the million tons of the author's standard sections which have been rolled, most up to the present time have been of 50 and 56 lbs. per yard, and but few of 60 lbs. The sections of 70 and even 80 lbs., though published with the others as far back as 1870, have never been adopted. To continue designing the sections on the same basis, the 90-lb. section would be 5½ in. in height and in width of base, while the 100-lb. section should be 6 in., with an equally strong head and web, as that of the English bull-headed rail. These heavy rails should be joined, in countries where the climate is mild, with deep angle-fishes, and the joints would then be of the same stiffness as the rail in the middle; but in countries with a severe climate they should be joined with angular fish-plates, though the joints would then have only two-thirds of the stiffness of the rails, but the width of base would be increased by, say, 3 in., making with the fish-plates 9 in. at the joints.

In suggesting this radical mode of improvement of the railways using flange rail-sections, the author is quite prepared to meet with great opposition from permanent-way engineers; but if they take the safety of the traveling public duly into consideration (and they will be the first to be blamed when accidents occur), and again, if they take the saving in maintenance of road, and particularly in rolling stock, into account—to say nothing of the comfort in traveling—they may gradually come round to these views, and make a change for the better, in order to meet the demands of the future before it is too late.

(TO BE CONTINUED.)

The Telegraph as Applied to Train Movement.

[From a forthcoming work by J. J. Turner, Superintendent, First, Third and Fifth Divisions, Chicago, St. Louis & Pittsburgh Railroad.]

V.

CHAPTER XXIV.—*Running Trains by Block Signals, Without Regard to the Right of the Road.*—At some terminal stations where a large traffic from branch lines accumulates, it is found impossible to move trains in the ordinary manner. Trains use this portion of the track, leave it at a junction, and are never seen by those from other branches.

The whole system of train running, as heretofore explained, is based on the ability of men in charge of trains to see and know every other train which will affect their movements, and at ordinary junction points, where the traffic is light, registers are introduced, upon which conductors register the arrival and departure of their trains, which enables trains arriving at that point on the branch line to ascertain what trains have passed on the main line, or *vice versa*.

If at terminals where there are a good many junctions and a large number of trains, this plan were in force, it would cause aggravating delays and confusion, while stoppages were made to examine the register.

It is customary, at points of this kind, to have a double track with a series of block stations close together. Trainmen run from one block to the next, entirely on the authority of the signal given them from the station and without regard to anything that may be due. I know of no place where this is in use that any provision is made for a slow train to allow a fast one to pass, the distance usually being so short that they are allowed to proceed in the order they are received.

It is possible to make this plan of dispatching trains much more effective than is generally supposed; indeed, it is now in use on a portion of the Jeffersonville, Madison & Indianapolis road, which is single track, trains being put on junctions and sidings without touching a switch or knowing the object of the disposition which is made of them.

By permission of Mr. E. W. McKenna, Superintendent of the road, who is the originator of the system, the following article, read by him before the Train Dispatchers' Meeting, at Louisville, Ky., is here quoted:

"The present system of train dispatching has been in vogue, with very slight changes or improvements, since it was first introduced on the Erie Railroad more than 30 years ago. The principles then adopted filled an 'aching void,' the only addition since being the 'double order' system, which had its inception upon the Pittsburgh, Fort Wayne & Chicago Railway about the year 1859, and has since found its way, with slight alterations or changes, upon all the leading lines of railway upon the continent.

"When we call to mind the number of bright men who have attained eminence in the profession from the vantage of the train dispatcher's chair, it is a matter of extreme surprise that so little development has been made in an element so vital to safe and economic train movement. The writer's experience justifies the broad statement that the present system of moving trains by telegraph is unworthy of the age of progress in which we live, and the time has come when it can and will be largely improved upon.

"The most important consideration of the present system of moving by telegraph is the danger thereunder. We have,

"*First.* The train dispatcher, whose brain is bubbling with mental calculation.

"*Second.* The two or more receivers of the order directing two or more movements of trains.

"*Third.* The four or more conductor and engineers who receive and act upon such orders.

"It is in the experience of all train dispatchers that the operators, as a rule, who handle these orders are not possessed of the highest mentality, or even noted for their chirography. The train dispatcher under the double-order system is very little liable to mistakes, but is it not in the experience of every dispatcher that operators forget and actually change signals from 'danger' to 'clear' when orders involving large property interests and the stupendous consideration of human life lie under their very eyes? The illegibility of the hand-writing in the orders that must be translated by the conductor and the engineer is another source of danger.

Let us consider the possible improvements in telegraphic train movement as it is to-day:

"*First.* The elimination of the danger of accident connected with the present system.

(*Copyright, 1885, by J. J. Turner.*)

"*Second.* The obviation of delay to trains that are liable under the present system.

"*Third.* The economies that can be subserved by saving a large percentage of stoppages to trains.

"Taking up the first proposition, I cannot better illustrate the theory I propose to discuss than by calling attention to the manner in which trains are handled upon the Louisville Bridge, and the system of railroads leading thereto from the north. Previous to 1879, the only roads using the bridge were the Jeffersonville, Madison & Indianapolis and the Ohio & Mississippi roads. The Louisville, New Albany & Chicago Railway was operated as a local road and did very little business in Louisville, its traffic being handled by the Jeffersonville, Madison & Indianapolis Railroad. In the latter part of 1879 this property fell into the hands of strong people, who added largely to its equipment and expended large sums of money in the rehabilitation of its physical structure. This, combined with the purchase of the property for terminal facilities in Louisville, placed them in the position of a vigorous aspirant for traffic in this city, and from the South. Following this, the Louisville, Evansville & St. Louis Railway was completed in the year 1882. These accretions to the traffic and the augmented business of the older roads increased the number of trains upon the bridge from 60 per day of 17 hours to almost double that number. When this condition of affairs was reached, delays were the rule and accidents the exception. Fortunately, the accidents were not of a serious nature, as the system under which we were operating was so crude that it induced a tender-footedness that produced extreme caution on the part of all concerned. But, still, accidents of a trivial and once in a while of a serious nature did occur. The position was as follows:

"The passenger station of the four roads to the north and west is located at the corner of Fourteenth and Main streets. This station is about 1,800 ft. south of the end of the bridge, which is reached by a divergence to the right upon a curvature of 9 degrees. Equi-distant between the starting point and the gauntlet—*i. e.*, the bridge—stands a square brick building that imposes an absolute barrier to the vision. One mile and a half north of the starting point, at Prison station, the New Albany Branch diverges from the main line. One mile further north the Ohio & Mississippi line diverges, and the Jeffersonville, Madison & Indianapolis continues to the north, this station being known as North Tower.

"Continuing to the west from Prison station, the track is double to a point 2⅛ miles west. Half way between these points these tracks are intersected by the Jeffersonville Branch; 1¼ miles west of the end of the double track (at Vincennes street, New Albany) the Louisville, New Albany & Chicago Railway diverges; one mile further west, at State street, the Louisville, Evansville & St. Louis Railway diverges; about 1,500 ft. north of Prison station is the entrance to the Ohio & Mississippi yard. The yards of the several roads in Louisville lie north of the passenger station and south of the bridge. From the above you will gather that there are four junctions, viz.: State street, Vincennes street, Prison station and North Tower. The number of trains using the road described (less than eight miles in all), is in excess of 120 per diem, and the entire movement is between 6 a. m. and 11 p. m., a period of 17 hours.

"To add to the complications of the situation, previous to the adoption of standard time each line had a separate standard, the different roads using solar time at Chicago, Vincennes, Louisville and Indianapolis, respectively. The only means of moving trains with any degree of safety was in the strict carrying out of a system of registering at each of the junction and terminal points. The time thus consumed represented a great loss, and the oversight of trainmen in examining the registers, or proceeding from insufficient information, brought to pass the casualties heretofore referred to. The impossibility of keeping trains on time, and the fact that one train off time in this intervolved movement threw the whole movement into confusion and necessitated the issuing of train-orders to all trains; the time consumed in handling each of these orders, not to speak of the elements of danger they contained, was almost equal to the time necessary for the movement.

"The delays thus incurred and the unsafe system of moving trains called for a remedy, and it was applied as follows: The portion of road in question was divided into five blocks, namely:

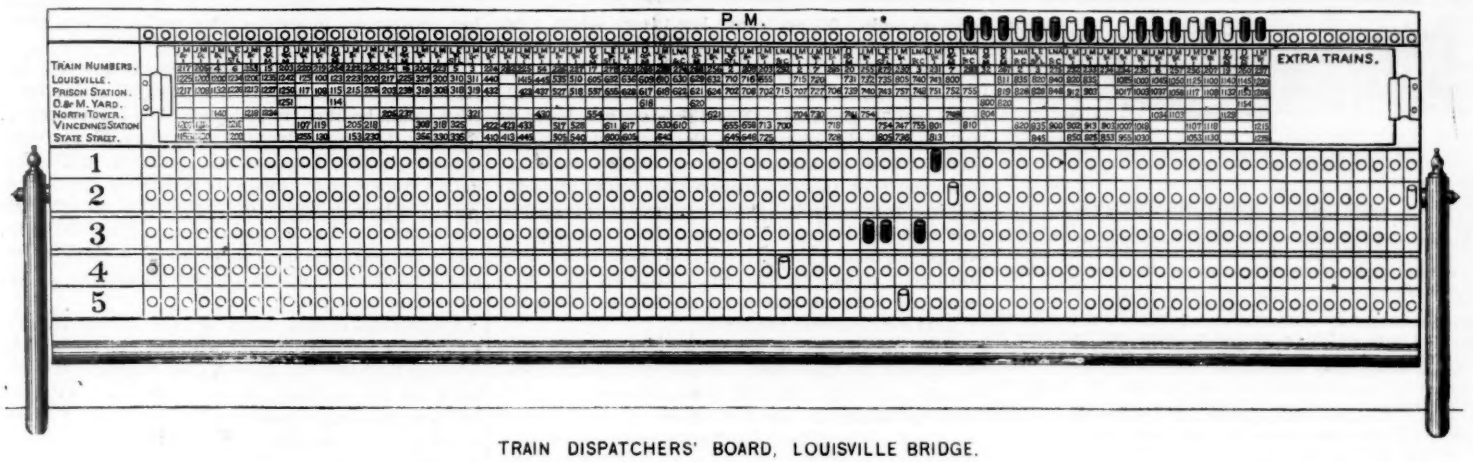
"Block No. 1, Louisville to Prison station.
"Block No. 2, Prison station to North Tower.
"Block No. 3, Prison station to end of double track.
"Block No. 4, end of double track to Vincennes street.
"Block No. 5, Vincennes street to State street.

"Signal stations were erected at each of the dividing points, equipped with the Pennsylvania Railroad standard block signal, showing the three colors. The rules governing the train movements were made as few and as simple as possible, and were in effect the principles designated by the colors. Trains were governed entirely by the signal displayed from the station, and the character of signal to be shown was directed by the dispatcher. The formula used is as follows:

"Prison station will report L., N. A. & C. No. 2 coming on block No. 3. The dispatcher will say 'white,' to which the operator at Prison station responds 'white,' and reports O. & M., No. 52 coming on block 2. The trains from block 3 having entered block 1 under white signal, the O. & M. train enters under a green signal, the order being given in a single word by their train dispatcher, and the understanding being announced by the operator in the simple repetition of the same word.

"Of course the operators at each of the stations report trains in and out, as is customary elsewhere. There is a special wire devoted exclusively to this work. This system represents a combination of the English double-track permissive block system and the Gauntlet system as used in some small degree in different parts of this country. It differs from any system that is in use, however, in the one important feature, that one man does the thinking of 240 men, that is, for a conductor and enginemen to each of the 120 daily trains. These trainmen have no knowledge or care for the movements of other trains, as their authority to move is conveyed to them by the signal, and they move with rapidity and full confidence as to their right to be where they are. There are a number of electric and semaphore signals, connected with the system, including starting, warning, distant and home signals, for the protection of exposed points. There is nothing novel in character connected with these signals and a description is unnecessary.

"One of the most difficult features to overcome in working this system up was to guard against forgetfulness on the part of the train dispatcher. This was finally overcome in a very simple way. A board about 5 in. wide by 30 in. long, perforated with seven lines of holes like a cribbage board, running from left to right. On the left-hand margin of the board is written opposite these lines of holes the terminal points and the number of the different blocks. On the upper edge of the board is a list of the trains arranged in a sequence of time, starting with the first one in the morning and ending with the last one at night. The board is divided by a line in the centre, the left-hand half being devoted to trains going south. Immediately under the time slip of each train is a cribbage peg—white for trains going north, red for trains going south. The white pegs travel down the board, the red pegs travel up. Before the first movement in the



TRAIN DISPATCHERS' BOARD, LOUISVILLE BRIDGE.

morning the white pegs stand in a row at the upper left-hand side of the board; the red pegs in the like fashion at the lower right side of the board, like two lines of red and white soldiers at company front. With the movement of the first train, either from north or south (or the two movements may be simultaneous) for the train going north, while the train dispatcher with his right hand upon the key authorizes the movement with his left hand. He moves the peg that represents the train from the line to the left of Louisville, and places it in the line opposite block No. 1. As it continues its journey he authorizes it to enter block 3, 4, and 5, and with each movement he moves the peg until it reaches the bottom of the board, and the trip of that train belongs to the past. At midnight the pegs have reversed their position; the red ones are at the top, the white ones at the bottom, and their work for the day is over.

"The train dispatcher, no matter how his attention may be abstracted, or how suddenly he may be confronted with an unexpected movement in the shape of a special train coming to one of the junction points unannounced, has not to stop and locate in his mind the various moving trains, but a single glance at this mnemonic board tells him in an instant. This system has been in operation since the first Sunday in January, 1882, a period of 930 days. In that time 111,600 trains have made complete trips in the blocked section, necessitating the giving of directions by the dispatcher as to the color to be shown an average of four times to each trip; each direction constituting a movement gives a total of 446,400 movements, without an accident, save one, that could be even remotely attributed to the system.

"During the 930 days mentioned there have been four train accidents, three of which were directly attributable to carelessness on the part of trainmen in failing to properly protect their trains by signal; and one in which the signal system had a contingent interest. The loss by the accident did not exceed $50, and it is unnecessary to go into an explanation of the causes that produced it. Suffice it to say that it was rather a comfort than otherwise, as it demonstrated the fact that it required a combination of at least three factors to produce it—1, the dispatcher; 2, the signal man at Prison station; 3, the trainmen in charge of the train that was stalled upon the main track failed to protect their train.

"Even then the accident would not have occurred except that the morning was very foggy. Previous to the time that this theory of train movement was inaugurated the annual loss from accidents approximated $15,000, superadded to which was the ever potent possibility of a disaster, incalculable as to the material loss that might ensue and the lives that might be sacrificed.

"Before leaving this portion of the subject I desire to present an odd calculation under the old system—that is, running trains by time-card. On a number of days when the movement was exceptionally good, it was ascertained that the whole sum of delay to all trains reduced to one train amounted to more than three hours. This is a considerble delay applied to one train, but spread over the whole number amounted to only 1½ minutesto each train. At the same time a delay of 1½ minutes daily to each train amounts to a delay to one train of three hours daily, and in one year to a total delay of 41 days and 11 hours to one train. If the delays that did occur could have applied ratably to each of the trains involved in the proportion of 1½ minutes to each, attention would not have been called to the matter at all; but, unfortunately, such was not the case, and, as always happens the trains that should have suffered the least delay suffered the most.

Foreign Technical Notes.

The Prussian Minister of Public Works has directed that in cases of pressing necessity passengers may be carried by freight trains, in what is equivalent to our conductor's car. The passenger must have a first-class ticket and in addition pay the sum of 73 cents, which will make it sure that no one will ride unless there is indeed pressing necessity.

The Prussian State railroads offer certain rewards for the discovery of defects in road and rolling stock that might cause accident, provided notice is given early enough to prevent further damage, namely:

For finding a break or crack in a rail or iron sleeper, or in a frog, which locomotives run over, 36 cents to $1.45; for a crack in an axle, $1.45 to $3.60; for a fracture or crack in a tire, 36 cents to $1.45; for a fracture or crack in a Bessemer steel or cast steel wheel, 73 cents to $1.45; for a fracture in the hub of a wheel or a wheel loose on its axle, 36 cents to $1.45.

Further discretion may be used in giving rewards as follows, when more than ordinary attention is necessary to discover the defects:

For fractures of parts of the coupling apparatus, including the draw-bar and the draw-hooks, 24 to 73 cents; for defects in pistons, piston rods, connecting and coupling rods, crank-pins and boilers, 36 cents to $3.60.

Shop men also may be given premiums for discovering some of these defects, when special attention is necessary. In all cases notice of the discovery, must be given to the man's immediate superior, who on confirming it will report the case for the reward.

IRON TIES.

Gustav Meyer, in the German *Organ for Railroad Progress*, discusses the comparative annual cost of different materials for ties. Herr Meyer deduces his annual cost on the basis of the yearly payment necessary to form a sinking fund, which at 4 per cent. compound interest shall replace the tie when used up. This yearly payment will be

$$\frac{0.04}{1.04^{n+1} - 1.40} C,$$

where C is the first cost of a tie, and n the number of years it lasts.*

If, instead of the original price of the tie, we put for C the first cost plus the cost of changing out and minus the value of the old tie after removal, we obtain the exact annual charge per tie in the road-bed necessary to renew the ties. Herr Meyer has assumed the value of an old wooden tie as being one-tenth of its original cost, an old iron tie as being worth 40 per cent. and that the cost of changing out is 15 cents, and deduces values of renewal found from above formula, which, added to interest for the first cost of tie, give the following tables, which are applicable to our roads if the rate of interest and the other assumptions are conceded as correct.

TABLE I.—WOODEN TIES.

Original cost of tie.	Yearly expense of a wooden tie in cents. Value of removed tie = 0.1 of original price: Cost of changing out = 15 cents. Life in years.								
	4	5	6	7	8	9	10	11	12
Cents.									
25	9.5	7.8	6.5	5.5	5.0	4.5	4.0	3.8	3.5
50	15.5	12.8	10.8	9.3	8.3	7.5	6.8	6.3	5.8
75	.....	17.8	15.0	13.0	11.5	10.5	9.5	8.8	8.3
100	.....	.....	.....	16.8	15.0	13.8	12.5	11.5	10.8
125	.....	.....	.....	.....	.....	17.0	15.3	14.0	13.3
150	.....	.....	.....	.....	.....	.....	.....	16.8	15.8
175	.....	.....	.....	.....	.....	.....	.....	.....	.....
200	.....	.....	.....	.....	.....	.....	.....	.....	.....
225	.....	.....	.....	.....	.....	.....	.....	.....	.....
250	.....	.....	.....	.....	.....	.....	.....	.....	.....

Original cost of tie.	Yearly expense of a wooden tie in cents. Value of removed tie = 0.1 of original price: Cost of changing out = 15 cents. Life in years.							
	13	14	15	16	17	18	19	20
25	3.3	3.0	2.8	2.7	2.5	2.4	2.3	2.2
50	5.5	5.3	5.0	4.8	4.5	4.3	4.0	3.9
75	7.8	7.3	7.0	6.8	6.5	6.3	6.0	5.8
100	10.0	9.5	9.0	8.8	8.3	8.0	7.8	7.5
125	12.5	11.8	11.3	10.8	10.3	9.8	9.5	9.3
150	14.8	14.0	13.3	12.8	12.3	11.8	11.3	10.8
175	17.0	16.0	15.3	14.8	14.0	13.5	13.0	12.5
200	.....	.....	17.3	16.8	16.0	15.3	14.8	14.3
225	.....	.....	.....	.....	17.8	17.3	16.5	16.0
250	.....	.....	.....	.....	.....	.....	18.3	17.8

TABLE II.—IRON TIES.

First cost of tie in cents.	Yearly expense of tie in cents. Value of old tie = 40 per cent. of original price: Cost of changing out = 15 cents. Life in years.								
	10	15	20	25	30	35	40	45	50
125	12.3	9.3	7.8	7.0	6.5	6.3	6.0	5.8	5.5
150	14.5	11.0	9.3	8.5	7.8	7.5	7.0	6.8	6.7
175	16.5	12.5	10.8	9.8	9.0	8.5	8.3	8.0	7.8
200	18.8	14.3	12.3	11.3	10.3	9.8	9.3	9.0	8.9
225	21.0	16.0	13.8	12.5	11.5	11.0	10.5	10.3	10.0
250	23.3	17.8	15.3	13.8	12.8	12.3	11.8	11.3	11.0

It would have been a little better for general application and perhaps nearer a proper basis if Herr Meyer had included in his annual cost not only interest on the original cost of tie, but also on the cost of first laying. We could then use the cost of tie and laying instead of the tie alone in using the prices in the first column, and the only assumption in which we should have to agree with Herr Meyer in using the table would be the comparative value of old and new ties.

As it is, the table will approximate our conditions rather better than by using it in that way.

As illustrating the operation of the table, compare it with a calculation recently made by the writer on the basis of the fund necessary to put in and forever replace certain kinds of ties.

Cost of ties with compound interest at 4½ per cent.:

For Southern Pine, lasting eight years, and costing 70 cents:

First cost	$0 70
Laying	0.20
Fund to renew every 8 years, including changing out	2.13
Total	$3.03

Yearly charge by table—interpolating a price between that for 75 cents and $1, to correspond with the 90 cents, which is the original cost of tie and laying—would be 13.6 cents.

For Hemlock preserved, lasting 12 years:

First cost with laying at 20 cents	$0.78
Fund to replace every 12 years	1.12
Total	$1.90

According to table annual cost = 8.6 cents.

For Steel Ties, say 120 lbs. as minimum, at 1½ cents:

First cost and laying at 20 cents	$2 00
Fund to replace every 50 years	0 25
Total	2.25

According to table annual cost = 8.9 cents.

The figures $1.90, $2.25 and $3 03 are as	1 : 1.18 : 1.60
" " 8.6, 8.9 and 13.6 " "	1 : 1.04 : 1.58

The result as to comparative advantage is approximately the same, in spite of the difference of interest rate, while if we assume the life of the steel tie to be only 30 years, the annual charge per tie from the table is 10.3, much more than the hemlock, but still considerably less than that of the unpreserved timber.

With wooden ties costing $1 and a life of 12 years. Herr Meyer shows a slight advantage in the the use of iron ties of an assumed life of 30 years.

He presents a table showing the life and cost of ties on a large number of German roads, with the annual cost as deduced from the table, from which it appears that with hard wood ties averaging unpreserved $1.06 apiece and preserved $1.40 apiece, and with pine ties preserved at 88 cents apiece and unpreserved 61 cents apiece, the line is practically reached where steel or iron ties are equally economical with preserved wood..

No inference as to the cost of preservation can be drawn from the above figures, as the companies which have taken to preserving have been driven to it by the high prices for wood along their lines.

Herr Meyer estimates the average cost of preserving at 50 pfennigs, or 12½ cents per tie.

From a table given by Herr Meyer of the German practice as to steel ties, it appears that the lowest approved weight of tie in use is 98 lbs., costing $1.42, while the average is 110 lbs., costing $1.78. This does not include the Austrian practice, where much heavier ties are used, going as high as 158 lbs. in the Arlberg tunnel.

In estimating the desirability of introducing metal ties, the greater distance between tie centres which can be used where the rails are sufficiently heavy to stand it, must be taken into account, particularly as the limiting minimum weight of a tie has to be decided rather by its resistance to deformation under a derailed wheel than by its rail-carrying capacity.

It is reported that, except in tunnels, where tar has proved an efficient protection, the ties do not rust in use more than the rails themselves.

Their durability appears to depend upon the mechanical action of the rail fastenings much more than upon chemical action from air or water.

The mechanical wear shows itself in looseness of rail fastening due to insufficient bearing surfaces of the parts against the tie.

Broken iron or steel ties are of very rare occurrence.

The following table shows the comparative prices for given lengths of life at which ties will be of the same value; that is, will cause the same annual expense:

Material.	When the life is	An annual expense of 10c. justifies payment per tie of	An annual expense of 11¼c. justifies payment per tie of
Wood	6 years.	45 cents.	50⅝ cents.
"	12 "	92½ "	105 "
"	14 "	105 "	120 "
"	20 "	137½ "	157½ "
Iron	20 "	161¼ "	182¼ "
"	25 "	178¾ "	201¾ "
"	30 "	192½ "	217⅛ "
"	35 "	210 "	231¾ "
"	40 "	215 "	242½ "
"	45 "	222½ "	251¼ "
"	50 "	227½ "	256¾ "

*If B is the yearly payment and f the rate of interest, the payment of B when the tie is put in will accumulate during the life of the tie to $B(1+f)^n$.

The second year's payment will accumulate to $B(1+f)^n - 1$.

" last " " " be $B(1+f)1$.

The sum of the series is $B\frac{(1+f)^{n+1}-(1+f)}{f} = C$.

Hence, $B = \frac{fC}{(1+f)^{n+1}-(1+f)}$.

RAILROAD GAZETTE

Published Every Friday.

EDITORIAL ANNOUNCEMENTS.

Passes.—*All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.*

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

COAL PRICES AND THE ANTHRACITE ROADS.

What seems to be an unaccountable confidence in greater profits by the anthracite coal roads has followed the announcement that leading bankers are trying to secure control of the Philadelphia & Reading Company and to secure harmony among the several anthracite companies. We believe that we are correct in saying that absolutely nothing more is known about the matter; yet, based on this, the knowledge that able financiers who can command an immense capital are trying to make these properties more profitable, the securities of the various coal companies have advanced in the aggregate several millions of dollars. The principals in this scheme are the same who so successfully conducted the arrangement by which the West Shore and the South Pennsylvania were taken out of the way last summer, making it possible for the trunk lines to get remunerative rates after nearly a year of throwing away profits, and it seems to be assumed that harmony among the anthracite roads should be followed by an advance in prices equal to what has taken place in trunk line stocks since last July. Indeed, the market has not waited for evidence that anything has been or can be done, but some of the coal stocks have already gone up in two weeks about as much as the trunk line stocks in six months, though there has been a considerable improvement in the business of the country to help the latter.

It is certainly desirable that the anthracite roads should work together harmoniously, and not throw away their reasonable profits by unreasonable competition. But the situation with them is not like that of the trunk lines last summer. There has not been anything like that reduction of rates by them, which the trunk lines suffered from last year, and their coal production and traffic was not small, but with one exception the largest they have ever had. It is true that they accepted low prices for coal and for transportation, but these low prices were chiefly due to the necessities of the situation, and only to a minor degree by their failure to coöperate closely. Doubtless they might have made larger profits than they did had they been more united, but nothing like as much more as the trunk lines could have made by coöperation.

The coal roads do not live by coal alone. A very important part of their earnings is due to manufactories on their lines, mostly great consumers of anthracite, which, and the people employed in them, need a great deal of transportation *when they are actively employed* and very little when they are idle. Now one of the conditions necessary to keep many of these works going last year was cheap coal. Indeed, not a few were closed in spite of cheap coal, and others, in spite of the cheapness of anthracite, substituted for part of their fuel supply the Pittsburgh coke, which of late years has been revolutionizing the blast furnace industry. The recent report of the pig iron production of the United States by the American Iron and Steel Association shows that what it gives as "anthracite" pig was equal to 70 per cent. of bituminous pig in 1883, to 62 per cent. in 1884 and to only 58 per cent. last year, while from 1884 to 1885 the bituminous production *increased* 116,869 tons, or more than 5 per cent., while the so-called anthracite production *decreased* 117,913 tons, or 7½ per cent. But this does not begin to tell the whole story. As the Association report says, "The anthracite figures require to be accompanied by the explanation that nearly all of the pig iron that has in late years been produced in anthracite furnaces, has really been made with a mixture of anthracite and coke, very little being made with anthracite alone. In 1884 only 246,570 net tons were produced with anthracite alone, and in 1885 only 277,913 net tons were produced."

Now, the amount of anthracite consumed in blast furnaces is not important. Even if the so-called "anthracite pig" were produced by it exclusively, it would have required but about 1,850,000 tons, which was but 6 per cent. of the total anthracite production. But the course of the consumption in blast furnaces throws a great deal of light on the immensely greater consumption in other industries almost everywhere east of the Alleghenies and north of the Potomac. Such of these industries as use large quantities of fuel cannot under existing circumstances afford to pay high prices for it, because they have to compete with works further west, which get very cheap fuel, and they are not compelled to pay high for anthracite, because bituminous coal and coke may be had by most of the larger consumers (the works using great quantities of fuel being for the most part west of the Hudson) at a moderate price, which tends to fall rather than rise.

It tends to fall because the discovery of natural gas near Pittsburgh and the utilization of it in many great works, and the prospect that it may take the place of coal not only near Pittsburgh but in iron works over a great extent of territory—perhaps even east of the Alleghenies—is reducing the consumption of the Pittsburgh coal and coke near Pittsburgh, and forcing it to search for a market elsewhere. The revival of the iron industry has come in time to lessen the severity of this competition between anthracite, Pittsburgh coal and coke, and natural gas, but it has not and will not put an end to it. *For manufacturing purposes*, there is a large extent of country where anthracite is now chiefly used which would to a great extent substitute other fuel for it, should there be a considerable advance in the price.

For domestic purposes most of New England, New York and New Jersey, and probably more than half the population of Pennsylvania, will continue to use anthracite even at a price much higher than that of bituminous. This is where the anthracite mines must look for the chief part of their profits. In 1880 this part of the country had a population of nearly 15,000,000, and has perhaps 17,000,000 now. Many people in them, especially farmers, use wood still, but these are not large fuel consumers, and all but a small percentage of the total domestic fuel consumption in this territory, which may be roughly described as that part of the country east of a line drawn from Buffalo to Washington, is anthracite. The consumption grows about as the population, and of course that does not grow at the rate of 10 or 7, or even 5 per cent. per year—probably less than 2 per cent.

But further west there is an immense territory in which anthracite is used to some extent, and where the use of it has been increasing at a much greater rate than further east. But there it is a costly fuel and forms but a small percentage of the total used, bituminous coal being usually very much cheaper, so that here a considerable advance in the price is likely to reduce the consumption considerably.

Thus it appears that the most that can be expected from a combination of the anthracite companies is an advance in the price for that part of it used for domestic purposes east of the Alleghenies. This is doubtless the larger part of the total consumption, but it will require a considerable advance in it to make a great figure in the aggregate earnings of all the anthracite companies, whose capital amounts to some hundreds of millions of dollars.

There are some features in the situation which may result favorably to these roads, but they will not be created by their combination. The greater activity in the iron and other manufacturing industries will require more fuel than last year. Greater general prosperity in the East, which is expected, will result in a larger domestic consumption. The farmers of the West are not likely to have much money to spend for anything, but they never burn much of the fuel, and in spite of their lack of profits, there seems to be greater activity in the trade and manufactures of the Western towns, which do burn anthracite. Industries will not be made prosperous by higher prices for fuel, but prosperous industries may make higher prices possible.

It is noticeable that the recent rise in prices of anthracite stocks has not affected them all alike, or as they would be likely to be benefited by higher prices. Reading stock has advanced more than 25 per cent. (from 18¾ to 25), Lackawanna from 118 to 135, New Jersey from 45 to 53, Delaware & Hudson from 90 to 108½; but Lehigh Valley only from 114 to 122, Erie common from 25 to 28½ and preferred from 53½ to 60, while Pennsylvania has not advanced a single point, standing about 110 before the announcement of the movement and now.

The two last named roads are not anthracite producers to a large extent, but with the exception of the Reading they are the largest coal carriers, and the rates for the carriage of anthracite vary with the price, so that they would profit greatly by an advance in the price. Last year the Pennsylvania produced at its mines 10¾ per cent. of the total, and the Erie only 2 per cent., against the Delaware & Hudson's 10½, the Lackawanna's 15¾, the Lehigh Valley's 19½, and the Reading's 37 per cent. (including Central of New Jersey). But while the Erie *produced* but 78,000 tons last year, it carried (including bituminous, which was not a very large amount) 6,137,000 tons in the year to Sept. 30, which is more than the production of any company except the Reading. In 1885 the coal and coke shipments over the Pennsylvania were 14,318,000 tons, when the Reading's anthracite production were 11,6?0,000 tons. Probably not half of this was anthracite, but anthracite goes in large quantities over lines whose profits go largely to the Pennsylvania, not included above, which is the movement over the "Pennsylvania Railroad Division" alone. It and the Erie will be among the largest beneficiaries by any advance in the price of anthracite which does not reduce consumption, the more so because they get longer hauls on it than most of the other roads.

RAIL PRODUCTION AND CONSUMPTION.

The statistics of the steel industry of the United States, collected and compiled for the American Iron and Steel Association by its vice-president and general manager, Mr. James M. Swank, is remarkable as showing that the production of Bessemer steel ingots in 1885 was larger than ever before, though the steel rail production then was the smallest for five years. What this means, of course, is that the use of steel for other purposes than rails is making rapid progress. How great this progress is may be gathered by a comparison of the production of Bessemer ingots and rails in successive years, as follows, in tons of 2,240 pounds:

	Ingots.	Rails.	Excess of ingots.
1874	171,370	129,414	41,956
1875	335,283	259,699	75,584
1876	469,659	368,289	101,370
1877	500,524	385,865	114,659
1878	653,772	491,427	162,346
1879	829,439	610,682	218,757
1880	1,074,262	852,196	222,066
1881	1,374,247	1,187,770	186,477
1882	1,514,688	1,284,067	230,621
1883	1,477,340	1,148,709	328,631
1884	1,375,531	996,983	378,548
1885	1,518,488	959,470	559,017

It is true that the excess of ingots cannot be taken as an absolute measure of the use of Bessemer steel for other purposes than rails, first, because there is some waste in rolling rails from the ingots, but chiefly because in some years, especially in 1880, 1881 and 1882, large quantities of Bessemer rails have been made from imported steel, as might be suspected from the fact that the rails were 77 per cent. of the ingots in 1877, 75 per cent. in 1878, and 74 per cent. in 1879, and in the next three years 79½, 86½ and 85 per cent. respectively. But since the imports of the materials for Bessemer rails have virtually ceased, in the last three years, the percentages have been 78, 72½ and 63 per cent. respectively—that is, barring the waste in rolling rails, 22, 27½ and 37 per cent. of the Bessemer production of the last three years has been taken for other uses than rails, and last year the takings for these other uses were 70 per cent. greater than in 1883.

This increasing use of steel was due to a very important extent, probably, to the great fall in the price, so that in the first eight months of last year the Bessemer steel was as cheap or cheaper than iron. The increase in the price of rails since has been so much greater than the increase in iron that there is not now the same inducement to substitute steel for iron, though preparations for making such substitutions were never so general.

It will be seen from the above table that the Bessemer rail production last year was 3¾ per cent. less than in 1884, and 25¼ per cent. less than in 1882, when it was largest. These figures do not show the whole decrease in rail production, however, because the pro-

duction of rails other than Bessemer almost ceased last year. For eight years the production of each kind and the total have been, in tons of 2,240 lbs.:

	Bessemer steel.	Open hearth steel.	Iron.	Total.
1878	491,427	8,390	288,295	788,112
1879	610,682	8,169	375,143	993,994
1880	852,196	12,156	440,859	1,305,211
1881	1,187,770	22,515	436,233	1,646,518
1882	1,284,007	20,326	203,459	1,507,852
1883	1,148,709	8,202	57,995	1,214,906
1884	996,983	2,384	22,821	1,022,188
1885	959,470	1,250	13,118	973,838

Thus our total rail production last year was the smallest since 1878, and indeed was not very much greater than in 1872 (892,857 tons), when nine-tenths of it was iron. The decrease from 1884 to 1885 was only 4¾ per cent., however, and the amount of decrease was equivalent only to 550 miles of track of 56-lb. rails, while the decrease in new railroads constructed was about 825 miles. The new railroad, however, probably did not require more than 315,000 tons last year, or less than one-third of the total production, leaving 659,000 tons for the maintenance of the 125,000 miles of road and 156,500 miles of *track* in operation at the beginning of the year, which would permit the renewal of about 3 per cent. of it only.

This seems a very inadequate quantity at first sight but it must be remembered that 49,000 miles of this track had been laid since about the middle of 1880, and by far the greater part of it of steel, so that very few renewals of this could be expected so soon; and we must also remember that at the end of 1885 more than 90,000 of the 156,000 miles of track were steel, all but a small part less than ten years old (because previous to 1875 the total production and imports of steel were only about sufficient for 10,000 miles of track), and that what iron was left was on the lines and parts of lines which suffer the least wear. Nevertheless, it is noticeable that the 66,000 miles of *iron* track at the beginning of 1885 must must have been more enduring than it is usually credited with being, since the total consumption for renewals during the year was but 10 tons per mile of this track, even if no steel track whatever had been renewed—evidence that iron is enduring when it is not much tried. Probably four-fifths or more of the whole gross tonnage movement of the country is over the 58 per cent. of steel track. Evidently most of the iron in track at the beginning of last year was old, because the total supply of iron rails since 1874 had been less than 3,300,000 tons, or about 37,300 miles of track, and for the last six years of that period had been 1,832,304 tons, or about 20,650 miles of track. Thus more than 29,000 miles of the iron track must have been more than ten years old and 45,000 more than six years old. This will all be renewed with steel finally, and probably within a comparatively few years. Indeed, the large orders for steel rails which within a few months have set the steel mills actively at work and advanced the price of rails from $26.50 to $34.50 are doubtless due chiefly to the need of renewing much of this old iron together with considerable old steel track.

The renewal of one-fourth of the iron track which is more than ten years old will require something like 615,000 tons of rails per year, and this would seem to be a moderate requirement; for though the iron rails are almost exclusively on roads of thin traffic, they are not to any great extent on the roads in new country, having been laid for the most part more than ten years ago, and of course not all, by any means, on new road then. It is not probable that there are many roads built more than ten years with traffic so light that it will not wear out iron rails, of the wretched quality usually procurable ten years ago, in 14 years.

Doubtless this old iron is mostly on roads which have not only a light traffic, but *light locomotives;* and where the latter are light enough, a very long life for iron rails is still possible; but the light locomotives tend to disappear quite rapidly, though they may last and be the most economical motive power for a long time yet or even permanently on some of the lines where they have taken refuge, over which there is scarcely ever necessity or possibility of hauling a heavy tram.

PRESERVING TIES AND TIMBER.

The review in another column of the recent able report of a committee of the American Society of Civil Engineers on the Preservation of Timber, by one who has himself had a large experience in the various processes for that purpose, will, it may be hoped, prove of practical utility to some of our readers by impressing anew on their attention a promising field for economy.

It is understood that nearly all the work of preparing the report fell upon the chairman of the committee, Mr. O. Chanute, of Kansas City, and no one who has examined it will question that it is a remarkably complete and valuable abstract of existing knowledge on the subject, almost every known process being discussed, theoretically, historically and statistically. The twenty appendices alone would make it a very valuable paper.

The substance of the final conclusions of this valuable report may be given in a few lines, namely:

Creosoting is the best and only absolutely reliable process, but burnettizing (chloride of zinc process) does very well for ties, and is cheaper. Open-grained, porous and sappy woods give the best results, but for ties the harder woods, beech, ash, maple, black and red oak, etc., are to be preferred. The removal of sap and injection of preservative should both be thoroughly and faithfully done, and there should be a certain interval if possible between preparing and using the timber. Finally, no "inspection," short of chemical analysis, will show whether the work has been well done or not after it is done, so that if contracted for, it should be only at a fair price with thoroughly responsible parties.

The vital question of economy the committee meet by showing that with oak ties at 50 cents, lasting eight years and (when treated at a cost of 25 cents) 16 years, the annual saving per tie by treating at the end of 16 years is about 6.25 — 4.7 = 1.55 cents per tie, and that with hemlock ties costing 25 cents and lasting four and 12 years, the annual saving per tie is about 6.25 — 4.17 = 2.08 cents per tie. This is without interest, which, as the committee says, is not strictly accurate, but the committee does not say that it also has the effect of exaggerating somewhat the actual saving and of exaggerating very materially the percentage of saving. If we compute the actual amount of the various investments at the end of the life of the prepared ties, at 6 per cent. compound interest, we obtain:

1 untreated oak tie at 50 cts., comp. int. for 16 years	$1.27
1 " " " " " " " " 8 "	0.79⅔
Total	$2.06⅔
Against	
1 treated oak tie at 75 ct., comp. int. for 16 years	1.90½
Saving in 16 years by treating	$0.16

Which is just 1 cent. per year, or nearly 8 per cent.

Similarly, for hemlock ties we have:

	Cents.
1 untreated tie at 25 cts., comp. int. for 12 years	50.3
1 " " " " " " 8 "	39.8
1 " " " " " " 4 "	31.5
Total	121.5
Against	
1 treated tie at 50 cts, comp. int. for 12 years	100.6
Saving in 12 years by treating	21.0

Which is 1¾ cents per year, or 17½ per cent.

The saving, however, is greater when the rate of interest is lower, and at 4 per cent. (which is all that is paid for money by several companies now) the 16 years of life of the treated oak ties would cost but $1.40½, while the untreated ties for the same time would cost $1.62, making the saving by treating 21⅞ cents, against 16 with interest at 6 per cent.; and the hemlock tie for 12 years would cost 80 cents treated and $1.03½ untreated, a saving of 23½ cents instead of 21 with interest at 6 per cent. Thus the value of durability is greatest when interest is least, and this may perhaps account for the comparative neglect of preservative processes in this country. It is not so very long ago that much of the money borrowed by railroad companies cost them as much as 10 per cent., and at that rate while an oak tie for 16 years would cost the large sum of $3.47½ untreated, it would cost but 2½ cents less treated.

This is but one of many instances in which the proper character of engineering structures is profoundly affected by the rate of interest on money, and the change has been so very great in this country of late years that it behooves designers to revise their calculations when they would ascertain the most economical type of structure, for if they depend upon conclusions which they reached ten or even fewer years ago, they may go very far wrong.

At 7 per cent., which not long ago was a common rate, the saving by treating, at these prices for ties and treating, was about 5 per cent. for oak and 12 per cent. for hemlock, and this was not great enough to encourage much experimenting with preservatives. The savings of 8 and 17 per cent. shown with interest at 6 per cent., which may now be regarded as the maximum for solvent companies, is somewhat more promising, and the 13½ and 22⅞ per cent. to be saved when companies pay but 4 per cent. interest is really tempting. The saving, however, is very much less than is shown by German experience, chiefly because the cost of preserving is given as but about half as great there as the 25 cents allowed above, and the cost of the untreated ties much greater, the treatment adding but one-sixth or one-seventh to the cost of the tie, while here it is calculated to add 50 or 100 per cent. to it.

The large increase in first cost due to treating in this country is still a serious obstacle to its general adoption. The whole of the increased cost, however productive in the end, returns absolutely nothing during the first eight years of life of a treated oak tie. Eight years is a long time to wait for a return on capital invested, and in this case the difficulty would be increased by the fact that it would not be easy to charge the increased cost of the preserved ties, when used for renewals, to capital account, where it properly belongs, and if charged to working expenses it would make a very considerable reduction in the net earnings for several years, and though this would be more than made good afterward, it might meanwhile seriously affect the credit of some companies, which credit may be of much greater economic value than all that could be saved by preserving wood—greater in the item of ties itself, for we have seen that the untreated oak tie that costs $3.47 for 16 years, when interest is 10 per cent., costs but $2.34 at 7 per cent., $2.07 at 6 and $1.62 at 4 per cent. The renewals in the United States in 1884 would have cost about $2,100,000 more if all the new ties had been treated; and the additional cost of the new track built from 1880 to 1885 would have been $31,000,000. The latter could have easily been charged to capital, but not the former, which would have reduced the net earnings about $110 per mile of track. This is not important to some companies, but to some it is; as to the Chicago, Milwaukee & St. Paul, whose divisible profits it would have reduced about $1 per share.

The best showing for the preservative processes is made by comparing cheap ties treated with dear ties untreated, as is done by Mr. Chanute in an official report as Chief Engineer of the Erie, which appears as an appendix. In all sections of the country where white oak ties are to be had at all, beech or other hard but not durable ties can be had for from 15 to 20 cents less, and by using hemlock or other inferior soft wood a difference of 25 or even 30 cents per tie may be shown. Mr. Chanute found that burnettized hemlock ties would cost the Erie five cents each less, laid in the track, than untreated white oak, while the life of the latter was taken as only seven years, against 12 for the burnettized hemlock. In this way there is a considerable immediate economy as well as a much larger one in the future, and even if harder ties were preferred and the cost of the treated ties were 5 or 10 cents more than the cost of white oak untreated, that difference might be borne when so large a sum as 25 cents additional would be deemed inadmissible. There can be no reasonable question that a burnettized or creosoted hemlock tie is a better and more durable tie than an untreated white oak, since it is now well established that either process is efficacious and that soft ties so treated do not cut to any objectionable extent, "cutting" being simply a local rot, greatly hastened beneath the rail by the constant abrasion of the surface, so that if the tendency to rot be stopped the tendency to cut is stopped. Since, therefore, there is no difficulty in obtaining most of the advantages of creosoting or burnettizing without sensible increase of outlay, or even with a decrease, the force of the otherwise plausible excuse, that a railroad company cannot afford to plant for posterity to reap, is destroyed.

It is, however, evident, that there is as yet no case made out for the *general* adoption of preserved ties in this country. The census of 1880 indicated that the average cost of ties for all the railroads in the country was but 25 cents each, and doubling the life of a 25-cent tie at an expense of 25 cents is paying for a tie several years before it is wanted, the only gain being the cost of putting in once. This apparent average, no doubt, is much too low, but the cost of ties was reported by different companies at from 10 to 92 cents, few paying more than 50 cents, and many, especially in the South, 25 cents or less. Nor is the cost in the older parts of the country always as much above the average. The Central Vermont in 1880 paid 22 cents (for cedar), the Eastern 30 cents, the Maine Central 27½, the New York & New England 32.7, the Buffalo, New York & Philadelphia 20, most of the Ohio roads less than 40 cents, though the largest ones paid more, many of the Michigan roads less than 30 (the Grand Rapids & Indiana 13½), while the Eastern trunk lines report the cost as 39 (Lackawanna), 47 (Erie), 50 (Pennsylvania) and 60 (New York Central). In nearly all cases this, doubtless, covers only the cost of the tie where received on the railroad, and not the cost of putting in, which must be added to ascertain the saving by lengthening the life of the tie. It is evident, therefore, that some roads have very much more to save than others by lengthening the

life of their ties, and it is these which naturally would first adopt preservative processes. The Southern Pacific of Arizona, for instance, whose redwood ties cost it 90 cents, while they last eight years, has much more to make by doubling their life than the San Francisco & North Pacific, which gets ties of the same wood for 25 cents. No company is going to spend large sums for preserving, unless the estimated saving is considerable, for the exact result cannot be positively known, and the treatment would be to a considerable extent experimental. Where oak ties cost as much as 60 cents, however, a case is made out for an important saving, especially for companies with the best credit, the saving at 6 per cent. being twice as great as when the cost is 30 cents. Not many railroads reported so high a cost as 60 in 1880, but among them were some important ones, as the United New Jersey (62 cents), and the New York Central (60). Were the cost of preserving as low as is reported in Germany 9 cents per tie) an entirely different phase would be put on the matter; no one could afford to use untreated ties.

Chicago Shipments Eastward in January.

The Chicago through shipments eastward in the month of January, by the complete report, including freight of all kinds except live stock and dressed beef, have been, in tons, for the last eight years:

Year.	Tons.	Year.	Tons.
1879	192,512	1883	271,162
1880	165,494	1884	234,704
1881	267,646	1885	322,073
1882	321 148	1886	167,665

Thus, the January shipments this year were less than in any other of the eight except 1880, and then, as in every year previous to 1884, the shipments of several junction points now given with the Chicago shipments were not included; and then the rate on grain to New York was 40 cents per 100 lbs., instead of 25 cents, as now; and then there were but five railroads carrying the traffic, instead of $1,000 of total earnings in 1880, there were about $625 this year, and for every $1,000 earned by the five old roads then, there is but about $440 now. Worse than that, for every $1,000 of *profit* then, there is about $400, and for every $1,000 of profit to the five old roads then, about $280 now. It should be said, however, that the rates obtained were considerably higher in 1880 than in any other year of the eight, and that only in one or two other years was the traffic large enough to make up for the difference in rates.

Compared with last year there was a decrease of no less than the eight which divide it now. For every 48 per cent. in the tons shipped, and though rates were not well maintained last year in January, they were not till a month later so low as to leave no profit, probably averaging as much as 20 cents per 100 pounds for grain. Rates were well maintained this year, probably better than in any other January, except, perhaps, 1880 and 1881. And if all the freight had been grain and flour, the profit on it would probably have been about as great this year as last, for the regular grain rate in both years was so low that a small reduction from it takes away half the profit.

Great as the decrease from last year has been, it was not as much as was indicated by the weekly reports of grain, flour and provision shipments. The shipments not included in these weekly reports amounted to 54,573 tons last year, and to 46,665 this year, the decrease in them being but 14½ per cent., while the decrease in the flour, grain and provision shipments reported weekly was 55 per cent.

It is, however, a very unfavorable sign that with the very low rates prevailing this winter—about as low as it is worth while to accept so long as the east-bound traffic is the larger, so that every additional car-load hauled from Chicago to New York implies a car hauled back empty from New York to Chicago—the freight movement from Chicago should be so very light—not only lighter than in any other January since records have been kept, but lighter than in any other winter month. The Chicago elevators have been and are full of wheat, but it was not wanted, and it has been held so long that it is now likely to remain where it is until the lakes open.

Chicago is not exceptional in this. It shipped about five times as much as St. Louis in January, and the total east-bound movement has been exceptionally light. Almost the only favorable symptom concerning this usually immense traffic is that, in spite of some irregularities which have been much talked about, but which can have affected only an insignificant proportion of total shipments, rates have been well maintained, and though recently there have been some suspicious movements by lines not heretofore suspected, those best informed both as to what is actually being done and as to the temper of the officers in control, think it extremely improbable that there will be any important disturbance of rates. The railroad men themselves have rarely had so little fault to find with each other.

West-bound Freight in January.

The west-bound through freight movement from the seaboard, which during the last four months of last year took such a favorable turn, came to a halt in January very suddenly and decidedly.

These through shipments, including all going as far west as the western termini of the Eastern trunk lines (Buffalo, Toronto, Pittsburgh, Wheeling, etc.), from New York, Philadelphia, Baltimore, Boston and a large number of interior New England points which take Boston rates, have been in January for the last seven years, in tons:

1880.	1881.	1882.	1883.	1884.	1885.	1886.
165,310	133,364	178,807	137,441	152,194	131,439	132,731

Thus the shipments this year were less than in any other of the seven except last year, and nearly the same as then. They are decidedly more favorable than last year, because nearly at the beginning of the month then the rates were reduced about 30 per cent. from the previous and the present schedule, which, it is seen, did not prevent the shipments from being 13 per cent. less than in 1884. The very large shipments of 1882 were largely due to a reduction of rates to about one-half of the present tariff. The profits from the shipments were therefore doubtless much larger than last year or in 1882: but they were less than in any year when rates were maintained, and the figures are significant chiefly as indicating the course of trade and the prosperity of the country. These shipments include most of the imported merchandise and a very large part of the manufactured goods consumed in the United States west of the Alleghenies, and that the consumption of these increases where the country is prosperous is shown very clearly by the course of the shipments in previous years. They were not reported for all the places until 1880, but the shipments from New York and Boston in January increased as follows:

1878.	1879.	1880.
57,347	63,694	102,368

gaining 60 per cent. from 1879 to 1880, in which latter year, however, they were greatly swelled by extraordinary importations of old rails, scrap iron and other foreign iron, very much less in value per ton than the average of other west-bound freight.

It would perhaps not be thought an unfavorable sign that as much freight should be shipped to the West this year as was shipped last at rates 30 per cent. lower, were it not that we had been shipping a good deal more than the year before during the fall months. The total west-bound shipments for the four months ending with December had been, in tons:

1880.	1881.	1882.	1883.	1884.	1885.
611,380	822,637	706,415	617,821	592,079	721,269

As in these four months next previous to January the shipments were 21¾ per cent. more than in the year before, and greater than in any previous year except during the railroad war of 1881, we are naturally surprised to see in January scarcely any increase over last year and smaller shipments than in any other year since 1879.

As west-bound rates were not fully restored until some time last November, the comparisons for the four months of 1885 are of a period of much less than average rates, wherefore it may be well to observe the course of the shipments in December, after rates had been restored, as follows:

1880.	1881.	1882.	1883.	1884.	1885.
133,215	170,552	132,890	121,652	117,321	137,052

showing them to have been larger last December than in any other except 1881, and 17 per cent. more than the year before, when rates were the same. If we compare the shipments in January with those of the previous December, we shall find that the January shipments were 4,321 tons the smaller this year, while they were 14,118 tons the larger last year, 30,542 tons larger in 1884, and somewhat larger in every previous year.

We are then forced to conclude that the West has ceased to buy goods as freely as it did less than two months ago, and that the west-bound movement no longer signifies growing prosperity. We must not place too much stress on a single month, nor conclude because the west-bound shipments did not increase in January, the country has reversed its course and is now going downhill instead of up, as it had been doing since summer. But these shipments are among the most significant facts of our national commerce, and if they continue as in January, it will be necessary to conclude that the country feels poor and means to keep down its expenditures. We might expect this from the light movement of the great products of the country, except cotton, and the greatly reduced exports; but then we should have expected it last fall, when the west-bound shipments were exceptionally large.

Storms and Structures.

The floods this week have well illustrated, as floods in every other week of this and every other year are very apt to do less perfectly, that "the natural end of a culvert is to perish in some excessive flood," as we said last year, and that it is difficult to build any large number of structures with such an ample margin of safety as to insure that many of them will not eventually wash out. This week's results are somewhat curious, since they have chanced to fall most severely on some of the Boston roads, which are about the oldest railroads in this country, and have rarely suffered much from floods and wash-outs heretofore. The Boston & Albany was opened to Worcester in 1835, and the Boston & Providence the same year, so that they are now over 50 years old. The Old Colony is comparatively youthful, being a little less than 40 years old, but on each of these roads structures were washed out in considerable numbers (on the Old Colony there were 40 wash-outs), many of which were "supposed to be strong enough to resist any current," and had succeeded in doing so for half a century.

Such occurrences will and ought to make engineers cautious, but there is another side to the apparent proof that mistakes were made by the engineers in laying out the structures, or at least bad judgment shown, which is worth glancing at, if only to save those gentlemen, most of whom have long been in their graves, from unjust reproach. To have insured that these structures should not have washed out in the present storm; it is probable that their original size and cost would have had to be nearly if not quite doubled, but had this been in the first instance a simple sum in compound interest shows that at this time the *additional* investment would have amounted at 6 per cent. to 19.50 times the actual first cost. It follows that in 1835 even a certainty of saving the cost of duplicating the original structure in 1886 would have warranted barely 5 per cent. additional expenditure. It is true that the bare cost of renewal does not cover the whole loss, for there is a loss from delay and danger of accident incurred by the wash-out in addition thereto, but on the other hand, to guard against all the contingencies which might arise in 1886, it would have been necessary in 1835 to have about doubled the cost of *all* the structures, since all may be assumed to have been laid out with equal care, and it could not have been foreseen which would be most tried thereafter.

All of which goes to show that when structures have been skillfully laid out to stand the ordinary contingencies of 20 or 30 years it is about all that is either practicable or justifiable, and that the remarkable storms which come only once or twice in a century are not in fact, and hardly can be, successfully guarded against. This is especially true because the worst effects of even the greatest storms are localized within quite narrow limits. The storms of last week are not by any means the worst for 50 years, except at a few spots. But those structures which have washed out this year chanced to be at those spots, while the really greater storms which have washed out others in past years did not chance to fall so severely on these.

The same is, in substance, true of inundations of railroad lines, a large number of which have been reported in the last two weeks. Every year we hear of miles of line of important roads being under water, and every year it is, to a considerable extent, in different localities. It is a tolerably safe prediction that within reasonable and justifiable limits of expenditure no railroad line can be carried for any long distance through that place of all places for economical operation, a river valley, without being at some time and at some point under water. The conclusion that whenever this occurs it is evidence of bad engineering is not justified. There are lines in all parts of the country which are overflowed for considerable distances every three or four years for a few days, and find it cheaper to suffer the evil than to correct it.

Without going to the length of saying that this is ordinarily justifiable, which would be going too far, it is an entirely safe statement that when the works endangered by such overflow are not of a very costly character, it is far better to risk the chances of overflow and damage at a few points every eight or ten or fifteen years, and often still more frequently, than to sacrifice the advantage of easy gradients and light first cost to avoid the risk, especially as it is often

impossible to avoid it without abandoning the valley altogether. This latter has been done in not a few instances, and by no means to the advantage of the property, although of course there are many valleys which are so frequently subject to excessive floods as to make them unfit for any permanent railroad line.

The New England Meeting and Gauge on Curves.

The joint meeting of the New England Railroad Club and the Boston Society of Civil Engineers barely managed to talk around the edges of the large programme of 24 subjects laid out for the Nov. 10 meeting, as might have been expected. The broad general topic of track *vs.* rolling stock is too large a one to be more than glanced at in one meeting, and it was fortunate that the discussion confined itself mainly to one particular branch of the topic, that of track and wheel gauges.

On this, as might have been expected, considerable diversity of opinion was elicited, especially as to how much play should be allowed on curves. This question is, however, as a matter of fact, passing beyond the point where it is profitable to discuss it, because practice is more and more decisively settling the fact that it is neither necessary nor expedient to allow any extra play whatever on curves. The practice of a large number of the leading roads has been to allow none for some years, and no evil results have been reported, nor have we heard of any road which has once established the rule and afterwards abandoned it.

The tendency of the outside rail to grind away by flange-wear would alone make this practice expedient, if safe, since the gauge is sure to be widened considerably in that way within a few years, in any event, but one has only to walk out into the nearest yard to see good *prima facie* evidence that in no event can it do much good.

Singularly enough, among all the large gathering of practical railroad men assembled at the meeting, no one alluded to this easily accessible evidence, nor seemed to be aware of it, but it is this: In almost every considerable yard there are one or two sharp curves over which a great deal of traffic passes, but always at slow speed. If the outer rail be very much elevated, as it often is, so much the better, for the result will not be affected thereby while the force of the evidence will be strengthened.

Now if any one will examine such a curve, he will find in all cases (unless the track is to tight gauge) that the *outer* rail is much ground away by flange-wear, precisely as if the speed were 50 miles an hour over it, and there were little or no super-elevation. If he will stand in front of a car being slowly pushed around such a curve, he will find that the front outer flange crowds sharply against the outer rail, showing, even without the evidence of the rail-wear, that no speed, however slow, and no super-elevation, however high (within the limits of practice), suffices to throw the wheels against the inner rail. If he watches the rear axle, he will find that the rear wheels stand close to the outer rail and away from the inner rail, but (if he watches closely enough) do not grind against either.

If he now examines the inner rail, he will find that it is worn indeed, and often more worn than the outer rail, but that it is worn *dead on top*, with more or less of a burr on the outside, and commonly on the inside also, but in no case with any evidence of flange-wear, as on the outside rail.

What does this prove? Plainly that the outer flange cuts the rail away for other reasons than that the gauge is too tight, or the speed too high, or the elevation too low (no one of which has much effect to increase or decrease the flange pressure); and we have only to reflect a moment to perceive that the probable cause (which is easily proved to be the actual cause) is the tendency of the truck to roll in a straight line. This, and not centrifugal force or the tightness of the gauge, is what forces the flange against the outside rail. As this tendency cannot be corrected by widening out the gauge or changing the speed or elevation, it follows that the grinding cannot either, and a very limited amount of observation will show that it is not.

The truth is that the inside rail plays no part whatever in guiding the truck around curves, but merely acts as support from below. This can be readily shown by a simple little experiment. Let any one push a car around a curve and observe how the wheels stand. Then, pushing it back to its original position, let him loosen one or two of the inside rails and move them out so wide of gauge that, if the wheels take the same path as before, they will barely have a fair bearing on the outside of the tread. It will be necessary to spike the rails down pretty firmly in this abnormal position, or they may turn over; but if this be done, it will be found that the path in which the wheels roll, relatively to the outside rail, is not affected in the slightest.

It costs little or nothing to make this test, and after making it, one will have a new light on the effect and the importance of widening gauge on curves.

We have reports of January earnings this week from 35 additional railroads, but they are chiefly small ones, the aggregate earnings of the 35 being no more than those of three of the larger roads reporting heretofore. Those reporting this week make a worse showing than the others. Eleven of the 35 have some increase in earnings. In some cases it is a large percentage of gain, but not usually a large amount. The earnings are given of two roads which have not reported before, the Indianapolis, Decatur & Springfield showing an increase of 18 per cent. and the Louisville, New Orleans & Texas an increase of no less than 60 per cent.; yet, after these large gains, the latter earned but $343 and the former $235 per mile. The other large percentages of gain are 36½ by the Marquette & Ontonagon, 18 by the Hoosac Tunnel, 25 by the Texas & Pacific (which had not reported before for a long time), and 61½ by the Texas & St. Louis, giving the latter $143 per mile. While the Texas & Pacific earned $87,000 more than last year, it earned $.05,500 less than in 1883.

There are many large decreases. That of 20½ per cent. by the Burlington, Cedar Rapids & Northern, of 14⅛ of the Iowa lines of the Illinois Central, of 39 per cent. by the St. Joseph & Grand Island, and of 22⅛ per cent. by the Wabash may be charged partly to snow blockades; but not that of 22 by the Charlotte, Columbia & Augusta, 24½ by the Columbia & Greenville, 15 by the Richmond & Danville and 41 by the Kansas City & Memphis.

The aggregate January earnings of the 64 railroads that have reported so far were:

	1886.	1885.	Decrease.	P. c.
Earnings.....	$13,608,905	$14,618,557	$1,009,652	6.9

February was a more unfavorable month for Western roads last year than January was this year, and consequently can easily be improved upon. But we shall not expect that the reports of Eastern roads yet to come in will be so unfavorable for January as the average of those that have reported so far.

While the special committee of the Senate has introduced a bill to regulate inter-state transportation providing for a National Railroad Commission, the so-called "Cullom bill," the House Committee on Commerce has had under consideration the Reagan bill, which has been introduced over and over again in successive congresses. This committee listened to testimony for and against the bill at several sessions last week; Mr. E. B. Stahlman, Third Vice-President of the Louisville & Nashville Company, and Mr. Geo. R. Blanchard, late Vice-President of the Erie, and recently appointed Commissioner of the Western connections of the trunk lines, appearing in opposition to the bill, and Mr. Rosewater, Editor of the Omaha *Bee*, in favor of it. It is almost impossible to say anything new on this proposed law. The ablest railroad men in the country have appeared before this same committee, and presented the facts and stated the principles governing the making of rates on competitive traffic, some of them not once only, but two or even more times. In each new Congress there are some new members of the committee, and this is made a pretext for summoning Mr. Fink, Mr. Blanchard, Mr. Adams and other authorities to give their testimony and opinions, which means that they shall prepare a small volume requiring much research as well as ability. This testimony is always printed; but the next time the question comes up the committee men are not content to read this printed testimony, but call for the experts to appear again and issue a new edition of the work that has been prepared for them. It is a sad commentary on the recklessness with which some men will legislate on matters vitally affecting vast property interests, that railroad men who believe the interests in their charge will be greatly injured by the passage of such a law urge the attendance of such witnesses and the repetition of their testimony, because, as they say, members of the committee would not take the trouble to read the printed testimony, while if present at the session of the committee they could not help hearing it if it were given orally.

It is expected that the Committee on Commerce will report in favor of the Reagan bill, and it may pass the House, as it has done before, but it is not likely to pass the Senate, where the Cullom bill will be urged.

Growth of Chicago Trade and Population.

The Chicago grain trade was very little less last year than in 1884, and has been exceeded in only three years, the receipts and shipments in *millions* of bushels (including flour) having been:

Year.	Receipts.	Shipments.	Year.	Receipts.	Shipments.
1870	60.4	54.7	1878	134.1	118.7
1871	83.5	71.8	1879	137.7	125.5
1872	88.4	83.4	1880	165.9	154.4
1873	98.9	91.6	1881	146.8	140.3
1874	95.6	84.0	1882	126.2	114.9
1875	81.1	72.4	1883	164.9	141.7
1876	97.7	87.2	1884	159.6	138.7
1877	94.4	90.7	1885	156.8	135.1

This shows that while the Chicago grain business has not grown for some years, its receipts are very well maintained, notwithstanding a great decrease in the exports and the receipts of the Atlantic ports. The excess of its receipts over its shipments has been extraordinary for the last three years, however. For the last three years this excess has been 66 million bushels, which is more than for the entire *six* years previous. Evidently the excess in the later years has been several times as great as the Chicago consumption, but it does not seem to be accounted for by the increase in the stocks on hand, though that has been large.

The live stock business was larger last year than ever before. The receipts of cattle were exceeded by 3,649 head in 1883, but then 1,296,910 fewer hogs were received; and when, in 1880, the hog receipts were greater by 121,818, the cattle receipts were less by 518,041. The cattle receipts have been nearly stationary for three years past, having increased very rapidly from 1878 till 1883 (76 per cent. in the five years). The hog receipts have fluctuated greatly, and for the three years from 1882 to 1884 were much less than in any of the four years from 1878 to 1881. Sheep receipts have been increasing at a great rate of late years, and were three times as great in 1885 as in 1880; but the 1,003,598 received in 1885 were probably equivalent in weight to no more than 250,000 hogs, and so form but an insignificant item in the total Chicago live stock receipts.

The other great staple of Chicago trade is lumber, and of this the receipts were 5 per cent. less last year than in 1884, and less than in any other year since 1880, and 18 per cent. less than in 1882.

It might seem from this that Chicago has no longer a basis for growth, since its trade in its great staples, except live stock, no longer grows. But the fact is that the great staples no longer have their former importance in Chicago business. They made the city, but it has now become probably more important as a distributor of merchandise than as a grain, cattle and lumber market. Some of the more Western towns are taking a large part of the *increase* in the trade in these staples. Kansas City has become a great live stock and packing point, and Minneapolis and Duluth great wheat markets. A portion of what these and other new towns receive passes through Chicago later, and some of it comes upon the market there, but only a portion. But Chicago is a great market for everything else, as no other Western city is, and these other things give occupation and income to vastly more people than are engaged in the trade in the great staples. The total trade of the city does not cease to grow though the grain, live stock and lumber shipments may, very much as is the case with New York.

Chicago, however, is not likely much longer to have the extraordinary growth which has distinguished it heretofore and which was the result of the occupation and development of the vast fertile territory tributary to it, because that territory is now so far occupied that there is no longer opportunity for the very rapid growth which occurred during the transformation of the prairies into farms. The state census of Iowa showed an increase in population of only 7 per cent. from 1880 to 1885, and there was more uncultivated prairie in Iowa in 1880 than in any other state bordering on the Mississippi. When the farming population has reached a certain point in the Western states it ceases to grow, though doubtless there remains the possibility of a great increase in production and the towns grow with great rapidity. In the country further west the unoccupied fertile land is now trifling in amount compared with what there was west of Chicago 15 or 20 years ago; and, moreover, it is so distant from Chicago that it requires and already supports considerable supply markets between it and Chicago, chief of which are Kansas City, Omaha, St. Paul, and Minneapolis. West of Lake Superior, where there is now the largest area of unoccupied prairie, lake transportation is likely to give the country an outlet for its products and an inlet for its supplies quite independent of Chicago, though here and still more further south, Chicago merchants still do a large part of the business. But Chicago is no longer the city nearest the frontier, and it may be expected to grow hereafter more like a city in an old country than like one in a new territory where population and production are doubling every few years. It is true that new kinds of business develop as the country around grows more densely peopled and has a larger town population, but on the average the rate of growth is not like what it used to be. From 1860 to 1870 Chicago's population increased 167 per cent.; from 1870 to 1880, 68 per cent.; it has possibly increased at something like the latter rate (about 5⅛ per cent. yearly) since 1880; but if so, it has now about 650,000 inhabitants, and no city of that size has ever gone on increasing at that rate, or could possibly do so very long. Even the average rate of increase of the whole United States in the last decade (30 per cent.), would give it an increase of nearly 200,000 in the next ten years, and make its population 1,100,000 in 1905. The increase of New York from 1870 to 1880 was 23½ per cent., of Philadelphia 25½, of Brooklyn 43, of Boston (but very largely by annexation) 45, of Baltimore 24, of Cin-

cinnati 18, and of St. Louis 13 per cent., these being all the places with more than 200,000 inhabitants in 1870. With the exception of Chicago and Brooklyn, none of these places increased as fast as the aggregate population of the country; but among smaller towns there are many examples of a much more rapid growth, San Francisco adding 57 per cent., Cleveland 72, Pittsburgh 82, Kansas City 73, Fall River 83, St. Paul 107, and Minneapolis 260 per cent. But this rapid growth is the growth of childhood and youth, not of maturity. A boy may have increased from 8 lbs. to 120 in the first 14 years of his life, but we may not, therefore, expect him to add 1,400 per cent. to his weight in the next 14 years and weigh 1,800 lbs. at the age of 28. When a town reaches a population of half a million or more a very moderate percentage of increase constitutes a very large addition; but meanwhile human beings are multiplied at the same moderate rate, and these great growths have to be imported. The addition of 68 per cent. to the population of Chicago in ten year, now requires the whole natural increase of more than 2,000,000 of people, at the rate indicated in this country, which is greater than anywhere else. A few towns with such growth would soon absorb the whole population of the country—leave not a soul on the farms or in the villages.

We may show this by examining the growth of the total city population of the United States. From 1850 to 1860 this increased 99 per cent., and was 2,897,600 in 1860. If it had continued at that rate, it would have been about 22,000,000 in 1880, whereas it was actually 11,318,547; going on further we should have, at the rate of growth from 1850 to 1860, a population of 87,000,000 in cities in 1900, when, if the very rapid growth of the whole population from 1870 to 1880 is continued, there will be but 84,500,000 people in the whole country. Twenty more years would give the cities 344,000,000—or 200,000,000 more than the whole country will contain with a growth of 30 per cent. per decade, as from 1870 to 1880—which is itself impossibly rapid for so long a period.

Chicago, however, is still apparently growing much faster in population than any other large city of the country, and for some time yet seems likely to grow faster than New York which alone exceeds it in the amount of its commerce, and shows no signs as yet of coming down to the moderate growth of the older Western cities, like Cincinnati and Saint Louis, though it probably will come down to something like it in time. Already the rate of growth of the leading towns 400 or 500 miles west, northwest and southwest is more rapid than Chicago's, and it will probably continue to be until the country west of them is pretty well occupied, as that between them and Chicago is now. Their rapid growth, however, is likely to cease long before they have reached anything like Chicago's proportions, because they have a much more limited area of fertile country to support them. Hence Chicago seems certain to hold its place as the great interior city and trade centre.

January Exports.

The breadstuffs exports last January were extremely small. For six years they have amounted in value to:

1881.	1882.	1883.	1884.	1885.	1886.
$14,929,408	$11,977,524	$15,835,077	$12,285,026	$17,872,413	$9,407,315

Thus the value of the exports this year was 42 per cent. less than last year, and less than in any other year of the six.

The *quantities* exported in each year have been, in bushels:

	Flour.	Wheat.	Corn.	All grain and flour.
1881	3,372,484	8,220,390	3,010,884	14.885,376
1882	2,172,289	6.772,511	1,659,579	10.808,562
1883	4,209.687	7,005,296	4,170.706	15,508,781
1884	3,823,497	5,040,889	2,543,562	11.797.603
1885	5,085,229	10,402,190	6,918,050	22.855,251
1886	2,656,831	4,018,808	6,074,432	13,074,703

The flour exports were smaller than in any other year of the six except 1882, after a crop nearly as light as that of last year. They were, however, larger than in any year previous to 1881. The wheat exports were not only less than in any other January given above, but also less than in any other January since 1877.

The aggregate flour and wheat shipments in January have been for the last nine years in *thousands* of bushels:

1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
6,840	8,205	7,808	11,593	8,945	11,215	8,864	15,487	6,676

Thus the exports of wheat and its product were smaller last January than in any other since 1877, when they were but 3,912,000 bushels. It is to be noted, however, that the January exports of both wheat and corn were larger last year than in any other. The *quantity* of grain of all kinds exported this year was 21 per cent. more than in 1882 and 10¾ per cent. more than in 1884, and was but 12 per cent. less than in 1881 and 15⅜ per cent. less than in 1883, through the *value* was much less this year than in any of these years. The ability of the country to export has not been reduced so much as many suppose, but a large part of the large decrease in value is due to lower prices, and another large part to the fact that the decrease is in wheat and flour, the highest priced grain.

For the seven months ending with January the value of the breadstuffs exports has been:

Year.		Year.	
1880-81	$168,509,580	1883-84	$100,299,652
1881-82	124,121,439	1884-85	97,572,920
1882-83	133,658,133	1885-86	62,406,047

For the seven months the value this year is 36 per cent. less than last year, 37¾ per cent. less than in 1883-84, 53 per cent. less than in 1882-83, and 63 per cent. less than in 1880-81. The amount of the decrease since 1880-81 is no less than $106,000,000.

The one encouraging fact in the report is that the corn exports were unusually large in January this year—larger than in any previous year except last year. This grain is likely to make the chief item in our grain exports until the next crop of wheat is ready to market, and it is possible that the exports of it may be very large, as in 1879, 1880 and 1881 (before harvest), when they several times exceeded 10,000,000 in a single month, and once (in June, 1880) passed 15,000,000.

The provision exports, including beef, pork, tallow, lard and dairy products, were lighter last January than in any corresponding month of which we have record, their value having been for the last six years.

Year.		Year.	
1881	$15,218,282	1884	$9.091,877
1882	13,200,379	1885	11.965,978
1883	10,978,825	1886	6,671,597

Here we have a decrease of 44 per cent. from last year, of 27 per cent. from 1884, and of 56 per cent. from 1881, when the value was greatest. Comparatively but a small part of the great decrease was due to lower prices, but it was chiefly owing to a reduction in the quantities exported. Thus, the exports of pork products in January have been in *millions* of pounds:

1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
95.2	125.2	126.1	92.0	144.5	104.0	84.0	65.7	109.3	69.7

Thus the January exports this year were less than in any other of the ten, except 1884; were 35 per cent. less than last year, and 52 per cent. less than in 1881, when they were largest. But it is not pork products alone that have decreased. Compared with last year, there is a decrease of more than one-half in the exports of fresh beef, of one-fifth in salt beef, of 44 per cent. in tallow, of one-fifth in butter, and of one-sixth in cheese.

In December there was a decrease of nearly 10 million pounds in the exports of pork products, but in November there was an increase of 10½ millions, and for the three months of the packing season ending with January these exports have been, in *millions* of pounds:

1878-79.	1879-80.	1880-81.	1881-82.	1882-83.	1883-84.	1884-85.	1885-86
361.1	303.9	411.1	271.0	213.4	229.4	259.4	230.8

The quantity this year for the three months is 15 per cent. less than last year, but about the same as in the two previous years; but compared with other years after a good corn crop the decrease is large—46 per cent. since 1880-81, 27 per cent. since 1880, and 39 per cent. since 1879.

The result is decidedly disappointing, for there was so large a corn crop last year, following another good crop, that exports something like those of 1879, 1880 or 1881 seemed quite probable—certainly more than in 1883-84, when there were 400 million bushels less corn.

Taking breadstuffs, provisions, cotton and petroleum together, which form the bulk of our exports, the value of our exports of them in January has been:

1883-84.	1884-85.	1885-86.
$56 492,923	$61,180,710	$42,810,927

a decrease of $18,370,000 (30 per cent.) since last year, and of $13,682,000 (24 per cent.) since 1883-84.

For the seven months of the fiscal year ending with January the value of these exports has been:

1883-84.	1884-85.	1885-86
$333,791,243	$346,500.432	$275,993,478

The decrease from last year is $70,507,000 (20½ per cent.), and from the year before $57,798,000 (17 per cent.), which percentages are much less than the percentages of decrease in January.

That the export values have kept up as well as they have is due chiefly to cotton, which made up more than half of the whole last January, and for the seven months was nearly the same this year as two years ago, though $33,000,000 (21½ per cent.) less than last year. The decrease is chiefly due to lower prices, though for the five months of the cotton crop year ending with January the quantity exported was 8 per cent. less this year than last, and in January 10 per cent. less, though the crop is supposed to have been about an eighth larger.

The petroleum exports both in quantity and value were larger this year than last in January, but for the seven months ending with January there was a small decrease both in quantity and value. The petroleum exports were worth one-fifth more than the corn exports last January, and more than half as much as the provision exports.

Chicago through rail shipments eastward for the week ending Feb. 13, by the incomplete Chicago report, including only flour, grain and provisions for the last two years, but by the complete pool report including all freight for the previous years, have been as follows:

1880.	1881.	1882.	1883.	1884.	1885.	1886.
38,493	54,105	66,499	58,140	38.732	46,041	36,503

The shipments were thus 20 per cent. less this year than last, but as allowing for the higher class freight, the total shipments this year were probably 49,000 to 52,000 tons; and were much larger than in 1880 or 1884, and not very much less than in the other three years.

For seven successive weeks the total shipments and the percentage taken by each railroad have been:

	Week ending.						
Tons:	Jan. 2.	Jan. 9.	Jan. 16.	Jan. 23.	Jan. 30.	Feb. 6.	Feb. 13.
Flour	4,495	3,206	3,804	4,416	3,551	5,564	4,366
Grain	19,440	17,056	10,713	12,736	12,344	17,868	22,789
Provisions	10,278	8,913	8,965	8,800	9,351	9,738	9,348
Total	34,213	29,175	23,482	25,952	25,246	33,170	36,503
Per cent.:							
C. & Grand T.	11.8	7.7	7.2	7.5	9.0	8.5	13.1
Mich. Cen.	11.0	13.4	12.0	12.0	12.0	12.1	11.4
Lake Shore	14.7	16.5	14.7	16.3	13.5	13.2	11.4
Nickel Plate	10.4	8.7	6.4	8.3	7.5	11.1	16.7
Ft. Wayne	16.4	16.2	23.7	18.1	21.6	18.9	18.1
C., St. L. & P.	13.8	11.8	16.4	12.4	16.1	13.2	13.1
Balt. & Ohio	8.9	13.5	12.0	14.9	11.1	11.3	6.4
Ch. & Atlantic	13.0	12.2	7.6	10.5	9.2	11 7	9.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Thus, the total shipments last week were the largest there have been this year, though they were small—smaller than in any December week. The gain over previous weeks was wholly in grain, of which 27⅜ per cent. more went forward than in the week before, and 84 per cent. more than two weeks before.

The changes in percentages are considerable and somewhat suspicious, there being great gains by the Chicago & Grand Trunk and the Nickel Plate, and a great loss by the Baltimore & Ohio, the Nickel Plate taking nearly one-half more than either the Michigan Central or the Lake Shore, and much more grain than any other road—21¾ per cent. of the whole; while next to it was the Chicago & Atlantic, with 15½ per cent. Thus, these two new roads, less favorably situated as to freight line connections than most of the other roads, carried about three-eighths of the grain, leaving bu 62¾ per cent. form the other six roads, including all the old ones. The two Pennsylvania roads took 45½ per cent. of the provisions, which is not unusual. The figures are such as might be caused by cutting rates on grain, the changes from the previous week being greater on some lines than is likely to occur when rates are maintained by all lines. Thus the *grain* shipments by each road for six weeks have been:

	Week ending.					
	Jan 9.	Jan.16.	Jan.23.	Jan.30.	Feb. 6.	Feb 13.
C. & Grand T	954	540	568	615	1.643	2,772
Mich. Cen	2,298	2,458	2,184	1,903	2.599	2,939
Lake Shore	3,084	1,904	1,806	1,240	1.995	2.457
Nickel Plate	1,193	662	957	1,184	1,909	4,962
Ft. Wayne	1,714	2,185	1,275	2,143	2.132	3 193
C., St. L. & P	1,338	581	454	1,145	1,708	1,842
Balt. & Ohio	3,122	1,706	2,949	1,951	2,220	1.090
Ch. & Atlantic	3,353	1,677	2,513	2,163	3 662	3,533
Total	17,056	10,713	12,736	12,344	17,868	22,789

There have been some disturbances since the first week of January by reason of snow blockades, chiefly by cutting off receipts from connections west of Chicago, but these will hardly account for the fact that when there was an increase of 84 per cent. in the grain shipments from the last week of January to the second week of February, the Chicago & Grand Trunk gained 350 per cent., and the Nickel Plate 320 per cent., while the Baltimore & Ohio carried 44 per cent. less.

Still, there are many circumstances which affect these shipments. An export demand might give considerable shipments to a line which, having few connections with the Eastern interior towns, might have next to nothing when there were no exports.

While there is no doubt that some grain has been taken from St. Louis at a great reduction from the regular rates, the complaints at Chicago that business has been diverted from that place seem to have a very slender foundation. For whatever the rates at St. Louis, the statistics show that they have not caused a large business to be done there, nor have they, so far as can be seen, increased its business. Thus for the six weeks ending Feb. 6 the receipts of corn at Chicago, St. Louis and Peoria and the total of the eight Northwestern markets have been:

Week to	Chicago.	St. Louis.	Peoria.	8 markets.
Jan. 2	1,611,369	679,130	70,155	2,564,935
" 9	556,058	256,080	82,160	1,067,511
" 16	268,481	88,080	84,975	517,818
" 23	612,562	316,810	138,960	1,289,842
" 30	730.221	329,915	329,459	1,729,408
Feb. 6	729,081	367,705	314,170	1,841,008

It was not till the last week of January that a considerable portion of the St. Louis shipments was taken at cut rates, and the increase in that time at St. Louis has been less than at Chicago or Peoria. Peoria has received very nearly as much as St. Louis, and Chicago more than twice as much. In the first four weeks St. Louis received 26½ per cent. of the total Northwestern receipts; in the last two weeks only 18 per cent. Meanwhile the share of Peoria has increased from 7 per cent. to 18 per cent.—a much more rapid increase than that at St. Louis.

So far as wheat is concerned, one might almost say that none has gone to the seaboard since navigation closed. For the three weeks ending Dec. 19 the total Atlantic wheat receipts were 1,217,799 bushels, which is less than in the first week of November; but for the next *six* weeks, Dec. 20 to Jan. 30, they were only 696,797 bushels—only tolerable receipts for a single week, even in the winter.

For the two months of December and January the Atlantic wheat receipts have been for four years:

1883.	1884.	1885.	1886.
9,580,234	3,699,254	5,742,543	1,914,596

So that the receipts this year were but one-third those of last year and one-fifth those of 1882-83.

The receipts at the Northwestern markets have not been so wretchedly small. A large interior population has to be supplied, or rather many interior mills, and these do not permit the Northwestern receipts to fall so low as the Atlantic receipts have been. Yet the Northwestern receipts have been very small, averaging little more than 500,000 bushels per week in January, against 1,547,000 last year, while for the two months December and January they have been:

1882-83.	1883-84	1884-85.	1885-86.
10,568,578	11,705,886	18,597,048	8,908,048

Thus the receipts this year were not half as great as last year, and a fourth less than the year before. Moreover, of the 8,908,048 bushels received this year in the nine weeks to Jan. 30, no less than 5,027,808 arrived in the first three of the weeks.

The wheat receipts recently, when they have been so very small, have often been quite evenly distributed among the several Northwestern markets. For instance, in the last week of January no place received more than 15.6 per cent. and no place less than 11.6 per cent. of the whole. And it is not very different with the Atlantic receipts. In the last week of January Montreal and Philadelphia received more wheat than New York and Baltimore nearly as much. Or

dinarily New York would receive 20 times as much as Montreal.

The promise of a large movement from the last corn crops held good in December, but not in January, when the receipts of the Northwestern markets were the smallest for five years, they having been in bushels :

Year.	Bushels.	Year.	Bushels.
1878.....	5,460,149	1883.....	10,114,478
1879.....	6,524,473	1884.....	11,581,970
1880.....	9,002,725	1885	11,096,123
1881.....	6,882,718	1886.....	7,359,504
1882.....	11,742,031		

The receipts were materially reduced this year, doubtless, by snow blockades, but this is not by any means the first January there have been such blockades. The decrease from last year is 34 per cent. when the receipts were about the same as the average of the last four years.

It is reported that a contract has been made to ship 30,000,000 ft. of lumber from Duluth to Chicago by lake. As Chicago ships lumber largely to Omaha and Kansas City, it is inferred that the lake rate from Duluth to Chicago, plus the rail rate from Chicago to Omaha, is lower than the rail rate from Duluth to Omaha. But the distance from Duluth to Omaha is but little more than the distance from Chicago to Omaha, and by the voyage of more than 600 miles from Duluth to Chicago the lumber is brought only about 30 miles nearer some of its principal markets.

It would seem the natural course of things that when the country in the vicinity of Duluth produces more lumber than is required directly west of it, to which it is the nearest source of supply, it should go directly southwest, and there take the place of lumber from Lake Michigan. But the railroads from Chicago west can afford lower rates than those from Lake Superior southwest so long as the produce of the points supplied goes to Chicago and does not go to Lake Superior. With their cars all going west for loads of grain and cattle, they will accept almost any rates required to fill them.

In the future, when the lumber of Michigan and eastern Wisconsin shall find a sufficient market east of the Mississippi, and a larger part of the supply of Nebraska and Kansas comes from the West Wisconsin and Minnesota pineries, there may be an effect on grain rates to Lake Superior like that now seen on lumber rates from Chicago. That is, the railroads from Lake Superior southwestward, having a paying traffic in lumber southwest, may make almost any rates necessary to attract shipments of grain back to Lake Superior from the places which consume the lumber. Were not most of these places on the lines of Chicago companies, this might have occurred already; but the Northwestern already controls lines to Lake Superior, and the Milwaukee & St. Paul and the Rock Island extend to within 160 miles, and the Chicago, Burlington & Quincy will soon be with them, all able to carry directly from the lumber regions to Missouri River towns and a vast territory east and west, which is not much further from Lake Superior than from Lake Michigan, and we may be sure that they will not be satisfied to have all the cars that go southwest with lumber go back empty.

The Northwestern Traffic Association, which pools the traffic between Chicago and Milwaukee on the east and St. Paul and Minneapolis on the west, reports for the two months of December and January last a remarkable decrease in earnings from the east-bound traffic covered by the pool, but a considerable increase in the west-bound earnings, the figures being:

	1885-86.	1884-85.	Inc. or Dec.	P. c
West-bound.....	$219,124	$192,010 +	$27,114	14.1
East-bound.....	69,788	179,679 —	109,891	61.1

There was not a great interruption to this traffic this year, and we see that there was a material gain in the west-bound movement, which, however, was but one-fourth as great as the decrease in the other direction (61 per cent.), which was extraordinary, and probably due to the fact that the flour and wheat shipments from Minneapolis were remarkably large in these two months last year, and remarkably small this year. There is scarcely anywhere in the country a traffic so much affected by the wheat and flour movement as that covered by this Association. Besides the 20,436 tons of east-bound freight reported above, coming from St. Paul and Minneapolis, the Association reports 21,814 tons of wheat milled at local points in the two months this year, the earnings on which were $72,287, 70 per cent. of which goes into the pool.

It is remarkable that with so light an east-bound traffic and with the condition of affairs likely to follow a moderate crop and the present exceedingly low prices for wheat in a country which produces little else for market, there should be such an increase in the demand for goods as is indicated by the gain in the west-bound business. This consists of merchandise to a greater extent than on most other routes west of Chicago, because St. Paul and Minneapolis do not get lumber from Lake Michigan, but from mills near by.

The traffic covered by the Pacific Coast Association is that between Chicago and St. Louis on the east and the Pacific coast on the west, over the lines east of the Missouri River. In January the earnings from it were :

East-bound.	West-bound.	Total.
$5,445	$41,068	$46,513

This traffic is divided among seven different railroads, the one getting most (Chicago & Northwestern) earning $12,578 from it in January, and the one getting least (Wabash) earning $2,189 from it. It is thus an almost insignigcant item in the earnings of any one railroad. Especially is this the case with the east-bound shipments, which are not only small in amount, but for the most part probably do not reach the roads in this association.

Of the $46,513 of total earnings from this traffic in January, the three roads to St. Louis, two of which carry to Chicago also, earned $10,442, whence we may conclude that the Pacific coast business *via* St. Louis is insignificant.

The earnings from the traffic covered by the Colorado-Utah Association, which is that between Chicago and St. Louis on the east and Colorado and Utah on the west, passing over the lines east of the Missouri River, were in December last:

East bound.	West-bound.	Total.
$48,760	$12,120	$58,880

The total is one-fourth more than the earnings of the same roads from the Pacific coast traffic in January, but whereas not one-eighth of the Pacific coast earnings were from east-bound traffic, nearly four-fifths of the Colorado-Utah earnings were from traffic in that direction. The business is shared by seven railroads, but the Chicago, Burlington & Quincy had 35 per cent. of it in January, and earned nearly three times as much from this as from the Pacific coast business. Next was the Rock Island, with 20 per cent., and the Chicago & Alton, with 15½ per cent., leaving but 29½ per cent. to the other four roads. These roads, however, carried considerably more than their allotted shares. A very large portion of this traffic, especially the Colorado traffic, goes by way of Kansas City, and thus gives an advantage to the roads with lines to both Kansas City and Council Bluffs.

The New York, New Haven & Hartford Railroad, whose earnings are chiefly from passengers, and depends but little on trunk-line traffic of any kind, made the important gain of 11⅓ per cent. in gross earnings in the last quarter of 1885, when the New York Central gained but 1 per cent., the Pennsylvania 1⅔ per cent., though the Erie gained 12 per cent. The gain of the New Haven indicates an improvement in local business in New England greater than the average improvement in the country.

The increase in working expenses for the quarter was but 7 per cent., and this leaves an increase of $109,749, or nearly 20 per cent., in net earnings, which of itself is at the rate of nearly 3 per cent. per year on the stock.

The New York elevated railroads report for the last quarter of 1885 an increase of nearly 4 per cent. in gross and 5¾ per cent. in net earnings. This is a moderate increase, but the business of the roads did not decrease last year, as that of most railroads did, and with gains of 4 per cent. a year and no losses, the earnings will soon be greatly increased. Owing chiefly to an increase in taxes, the surplus over taxes and interest was reduced from $484,266 to $435,946, or from $2.02 to $1.82 per share of stock.

The New York, Chicago & St. Louis (Nickel Plate) road reports for the last quarter of 1885 an increase of 10½ per cent. in gross and 27 per cent. in net earnings, but an increase in taxes and rentals makes the increase in the income available for payment of interest only from $211,991 to $238,720, or 12½ per cent. That there isa gain is, of course, favorable, but that a railroad 523 miles long between Buffalo and Chicago should be able to earn in the best quarter of the year only $456 per mile is anything but satisfactory. Even these light earnings, however, were just about enough to meet the interest on the first-mortgage bonds accruing for the quarter. There are now, however, liabilities for large amounts which have a lien prior to the first mortgage, and an equipment mortgage which requires $70,000 per quarter more. The road has a very respectable share of the through freight traffic, and the proportion of its earnings absorbed by expenses (exclusive of taxes) is not so large as might be expected on a road whose traffic is chiefly through trunk line freight, being in 1885 64⅛ per cent.

Illinois keeps its place as second only to Pennsylvania as a producer of steel rails, and last year greatly increased its lead over other states. Indeed, all the states, except Pennsylvania and Illinois, may almost be said to have gone out of the business last year, producing altogether only 26,646 tons out of the total production of 959,470 tons, though there are Bessemer works intended for rail making in New York, Ohio, Missouri and Colorado. The tons and percentage of the total produced in Pennsylvania, Illinois and all the rest of the country in each of the last five years have been :

Tons:	1881.	1882.	1883.	1884.	1885.
Penna.....	614,532	678,146	731,736	681,449	657,609
Illinois	309,171	300,169	206,567	259,094	275,216
Other states	264,066	305,812	210,406	56,440	26,645
Total...	1,187,769	1,284,067	1,148,709	996,983	959,470
Per cent:					
Penna.....	51.7	52.8	63.7	68.3	68.5
Illinois.....	26.0	23.4	18.0	26.0	28 7
Other	22.3	23.8	18 3	5.7	2.8

It seems remarkable that a state which imports both ore and fuel, and brings them long distances at that, should produce more than one-fourth of the rails made in the United States, and that of recent years, when prices were so low that only the works most favorably situated could make expenses, its proportion of the production should increase decidedly. But if Illinois is far from the raw materials, it is near the consumers of a very large part of the production, and is nearer than Pennsylvania to the ore most used for Bessemer metal, and has cheap transportation by lake from many of the furnaces in Ohio and Pennsylvania, the Bessemer works of Illinois being at Chicago and Joliet.

It would be an error to assume that the production of Bessemer *metal* has fallen off as much as the production of Bessemer *rails* outside of Pennsylvania and Illinois. Pretty much all the production of Bessemer metal in Illinois goes into rails, its production of ingots last year being 327,374 tons, against 275,216 tons of rails; but the "other states" which produced but 26,645 tons of steel rails made 201,843 tons of ingots; and Pennsylvania made 990,209 tons of ingots, and but 657,609 of rails. Illinois produced 28 7 per cent. of the rails, but only 21.5 per cent of the ingots, and Pennsylvania made 65.2 per cent. of the ingots and 68.5 of the rails.

THE reorganization of the Philadelphia & Reading Co., as noted in our columns last week, has been undertaken by a syndicate of bankers, whose general plan includes, it is understood, a foreclosure of the general mortgage and the issue of long 4 per cent. bonds for an amount sufficient to cover the present general mortgage and other prior liens, the balance of the bonds to be replaced by preferred stock. The plan, however, is not as yet very definitely laid down, and according to the programme issued by the syndicate it is to be made flexible, so as to meet any contingency which may arise. This syndicate is prepared to advance such amounts of money as may be needed, having, it is stated, $15,000,000 already subscribed for the purpose. As compensation for its work, it asks for a commission of 5 per cent. on the amount of its capital, interest at the rate of 6 per cent. on any money which it may advance in the course of the reorganization, and a provision in the new mortgages for refunding interest which it may pay on the general mortgage bonds during reconstruction. The syndicate will also ask to be substituted for any creditor or stockholder who may abandon his holding and refuse to pay such assessment as may be called. This proposition has been substantially accepted by the reorganization trustees appointed by the company, and a committee has been named to carry it out, and trustees have also been appointed to vote such stock as may be deposited in accordance with the plan.

This plan of reorganization by an outside syndicate is something new. The bankers and others who have joined in claim that their intention is simply to put the company on its feet again and thus remove the uncertainty which has attended its future and has made the fluctuation of its great volume of securities a standing menace to the general stock market. They are generally credited with the purpose of bringing the road substantially under the control of the Pennsylvania Railroad, and, indeed, announce that they have secured the promise of the coöperation of that company. Their representatives claim, however, that their purpose is to reorganize the Reading as an independent company, but having friendly relations with the Pennsylvania and with other connecting and competing roads. They are further credited by general reports with the purpose of organizing a combination which will include the Reading, the Pennsylvania, the Lehigh Valley and the Delaware, Lackawanna & Western, and which will thus control the anthracite coal trade.

Their proposed reorganization of the Reading will not be carried through without some opposition. The syndicate is credited with a large, but not a controlling, interest in general mortgage bonds, and further purchases have been checked by a rapid rise in prices of those bonds and by the refusal of many holders to part with their bonds at present. On the other hand, Mr. Gowen is actively opposing the new plan, and will, it is said, organize a syndicate of his own to oppose it. His announced intention is, through his new syndicate, to raise sufficient money to pay off the overdue interest on the general mortgage bonds, thus shutting off any foreclosure. Thus far he has referred to his intention only in the most general way, and has made no definite statement of his plan, but he has followers who believe that he will succeed in raising the money and in staving off further proceedings, for a time at any rate. Whether he succeeds in carrying out his own scheme or not, he will probably be able to delay materially the execution of any plan which he may oppose.

Although the Southern roads which are about to abandon the 5 ft. gauge voted unanimously to adopt 4 ft. 9. in. as their standard, there appears to be some feeling in favor of 4 ft. 8½ in., and it is said that the Cincinnati, New Orleans & Texas Pacific and its allied lines will be made of that gauge. Some of this feeling may appear at the adjourned convention this week.

The Committee on Wheel Gauge appointed at the Atlanta convention has adopted a standard wheel gauge, which, from the somewhat imperfect account received, seems to be the Master Car-Builders' standard, with 4 ft. 5⅝ in. as the distance between flanges.

The roads to which the test cars equipped with the 12 couplers selected for favorable mention at Buffalo have been assigned for trial are as follows :

LINK COUPLERS.

New York, Lake Erie & Western, Ames and Marks.
Lehigh Valley, Archer and Gifford.
Delaware, Lackawanna & Western, McKeen.
Chicago, Burlington & Quincy, Perry.

VERTICAL PLANE COUPLERS.

Pennsylvania, Cowell and Thurmond.
Baltimore & Ohio, Hien.
Chesapeake & Ohio, Titus & Bossinger.
Chicago, Rock Island & Pacific, Dowling.
Chicago, Milwaukee & St. Paul, Janney.

The general idea which has governed the distribution appears to have been that, so far as possible, couplers should be assigned to roads which, if not friendly, were certainly not unfriendly to the *type* (link or vertical plane) to which it belonged, but that, on the other hand, no coupler should be assigned to any road where there was any reason to believe that it might meet with special favor individually. That both these ends have not been fully assured in every case will seem probable to those who examine the list critically

with some knowledge of the facts, but ideal equality is rarely possible in such cases, and probably it would be no easy task to draw up a better or fairer list from the available roads, if the couplers were to be distributed around in this way at all. That there will be an intention to give each coupler perfectly fair play cannot be doubted.

A more radical objection to the distribution, however, which may yet give the committee some trouble or uneasiness, is that from the nature of the case it cannot give an exactly equitable result, since it does not give each coupler *the same* chance. If some one road could have been agreed on, where they could all have been placed under the same inspection and management, it would have removed at least one great danger, that with the best intentions in the world, one man's record of one coupler and another man's record of another coupler will differ because of the men or the service, and not because of the couplers. For the same desire to do exact and equal justice will lead one man to keep the cars at work as hard as possible and note the slightest adverse circumstances, and another man to let them take their chances like other cars and give the couplers the benefit of a doubt. This danger has been provided for as far as possible in the instructions of the committee, but it is but fair to remember that it exists, both now and when the committee's report is rendered, as it is all but impossible that with 12 couplers on 9 different roads, and with so few as 10 cars with each coupler to strike an average from, there should not be some real unequalities and still more claimed. If the cars could even have been placed on neighboring roads centring at one place, with some arrangements for a general supervision of them all, it would have done much to insure that entire equality in the records which is hard enough to secure at best. However, the committee have no doubt done the best which seemed possible under the circumstances, and it is to be hoped that no lurking fear of unfairness in the records when they come to be compared may interfere to prevent some definite conclusions from them.

A correspondent casts ridicule and contumely on the engraving of a level rod in the *Railroad Gazette* of Feb. 12, and asks: "If a leveler can't tell where he is on any particular figure of a rod without at the same time having his eyesight injured and his taste offended by the remarkable imitations of figures" in that engraving, "what is he going to do when he strikes the blank spaces between these extracts from a checker board?" And he adds: "What can you want more tasteful, more accurate and more practical than a plain, handsomely-formed block figure, six one-hundredths high, with all strokes just one-hundredth thick, and just half of each above and below the tenth mark? Even with plain I you are no worse off than with the blanks" of the rod we figured.

Tastefulness has little to do with graduating a level rod. Accuracy is certainly not injured by having jogs to indicate exactly each hundredth of a foot; and practically, a figure 0.08 ft. (1 in) high, as those shown, can be read a long way further off than one only 0.06 ft. (¾ in.) high, while at any considerable distance, as our correspondent will find by trying, the blocks and bars which compose the figures blend into each other, and give a distinct and very characteristic numeral.

The total through shipments from St. Louis in the first three weeks of January, before the Chesapeake & Ohio began to take any considerable part of the freight, were 14,353 tons, while the shipments from Chicago in the same time were 114,394 tons. Now, if the Chesapeake & Ohio by its low rates had doubled the St. Louis shipments, and the freight so attracted had come wholly from Chicago, it would amount to less than 3,500 tons a week, and be hardly appreciable in the Chicago shipments. But a large part of the St. Louis shipments are of freight that never goes to Chicago. In 1885 more than one-sixth of its total rail shipments were cotton.

The proportion of high-class freight shipped from Chicago tends to increase, though the very low rates of last year stimulated particularly the shipment by rail of grain, the freight of lowest class. In 1885 81.8 per cent. of the freight shipped from Chicago was of the 13th class, including grain, flour and mill stuffs, and the 12th, which includes nearly all the provisions. This leaves 18.2 per cent. of the other classes, nearly all bearing considerably higher rates than those of the 12th and 13th classes. The first four classes, however, amounted to but 122,692 tons, and 3.8 per cent. of the total shipments.

The higher-class freights are distributed very differently among different roads, and not always as might be expected. On one of the newer roads the 12th and 13th classes made 89.6 per cent. of its total last year, leaving but 10.4 of the higher, better paying classes, which formed 18.2 per cent of the total Chicago shipments; but on another of the newer roads 26.4 per cent. of its freight was of these higher classes—more than on any of the old roads.

Neither are the grain and provisions distributed alike, but one road which carried 22 per cent. of the 13th class (flour and grain) took but 12.4 per cent. of the 12th (provisions), and its next neighbor had 15.4 per cent. of the provisions and only 9.6 of the grain and flour. It seems at first astonishing and suspicious to find two of the old roads carrying 57.8 per cent. of all the first-class freight, until we see that all this first-class freight amounted to but 12,848 tons for the entire year, or 0.4 per cent. of the whole freight. The profit on it possibly may have been as much as on 150,000 tons of the 13th class freight, however. The smallest share of the grain and flour taken by any road last year was 8.1 per cent., but five roads took less than 10 per cent. each, and in the aggregate only 46 per cent., leaving 54 per cent. to the other three, one of which took 22 per cent. The smallest share of the provisions going by any road was 3.7 per cent.; the largest, 20.4. Three roads took only 18 per cent.

The temptation to cut to secure high-class freight is great, because usually a handsome profit is left after the cut. And a line with slight disadvantages usually has to cut pretty smartly to attract this freight, which does not move in large quantities, and on the price of which the rate of freight has very little effect. Consequently, where a new road gets much of this freight, it is considered pretty good evidence that it is cutting the rates.

The whole of the immense gain over last year made in the first month of the packing season (November) has been lost, and at the end of January the reports so far as received indicate that about the same number had been packed this year as last—less rather than more. There is a considerable gain at Kansas City (16 per cent.), and small ones elsewhere, but losses at several places, notably Indianapolis (9 per cent.), Louisville (27 per cent.), Cincinnati (11 per cent.), and St. Louis (10 per cent.). The Kansas City packing amounted to 25 per cent. of the Chicago packing this year, against 22 last year. It was 77 per cent. more than the St. Louis packing this year, and only 37 per cent. more last year.

Record of New Railroad Construction.

Information of the laying of track on new railroad lines is given in the current number of the *Railroad Gazette* as follows:

Marietta & North Georgia.—Extended from Ellijay, Ga., northeast to the Gilmer County line, 14 miles.

Natchez, Red River & Texas.—Extended from Frogmore, La., west to Trinity, 9 miles.

This is a total of 23 miles on 2 lines, making in all 114 miles thus far reported for the current year. The new track reported to the corresponding date for 15 years has been:

	Miles.		Miles.		Miles.
1886	114	1881	173	1876	99
1885	102	1880	246	1875	80
1884	155	1879	70	1874	83
1883	168	1878	170	1873	226
1882	419	1877	72	1872	169

These figures include *main track only*, second tracks and sidings not being counted.

NEW PUBLICATIONS.

Railway Life is the latest addition to the list of railroad journals, its first number having appeared under date of Feb. 4. It is published at Toronto, Ont., and in its prospectus promises to devote especial attention to the railroads of Canada. It will be, indeed, the first exclusively railroad paper published in the Dominion. It may perhaps be taken as an evidence of the close relations existing between Canada and the United States, that the initial number contains rather more news from this side of the line than from the other. There is a field, however, for the new paper, which is the more open perhaps from the fact that less attention than their importance deserves has heretofore been paid to Canadian railroad lines.

Freight Train Brake Tests.

The Committee on Freight Train Brakes of the Master Car-Builders' Association has addressed the following circular letter to the Railroad Commissioners of the several states; It is dated Aurora, Ill., Feb. 10:

The Master Car-Builders' Committee on automatic freight brakes has been endeavoring to bring about a competition test of the different brakes that are being introduced. A joint meeting of the Master Car-Builders' Committee and the representatives of different brakes was held at Harrisburg, Pa., Jan. 6.* From the interest manifested there seems to be now but little doubt that by April 1 the requisite number of entries will be made, and that a series of tests will take place at Burlington, Iowa, July 13, 1886. In this event our Committee will invite the Railroad Commissioners of the different states to be present.

We want to make these tests as thorough and complete as any that have yet been made. As there is considerable expense connected with such a trial the tests ought to be carefully and thoroughly worked out. If properly conducted there is no reason why the results should not become a permanent reference for all interested in this feature of freight train service. With this in view we would be glad of any suggestions of features of freight train brakes that in your Board's opinion should be brought out during the trial. We can receive communications up to April 1, 1886.

GODFREY W. RHODES, Chairman.

TECHNICAL.

Locomotive Building.

The Brooks Locomotive Works in Dunkirk, N. Y., are building 4 passenger engines for the Chicago, Rock Island & Pacific Road, with 18 by 24 in. cylinders and 68 in. driving wheels. The works have lately received an order for locomotives for the Union Pacific road.

The Rhode Island Locomotive Works in Providence have just completed a new ten-wheel freight engine for the Cheshire road. They have lately received an order for 12 locomotives for the Chicago, Burlington & Quincy road.

The Chicago, Burlington & Quincy shops are building 6 heavy six-wheel shifting engines, with separate tenders. These engines have 18 by 24 in. cylinders and driving wheels 52 in. in diameter.

The Cooke Locomotive Works in Paterson, N. J., have orders enough on hand to keep the shops busy for several months to come.

The Rogers Locomotive Works in Paterson, N. J., have been gradually increasing the force at work, and the shops will soon have a full number of men employed.

The Car Shops.

The Gilbert Car Works in Troy, N. Y., have just completed 3 Mann boudoir sleeping cars, which are to be shipped to Australia. The works are now building 3 sleeping cars for the Monarch Sleeping Car Co., 50 passenger cars for the Manhattan Elevated road in New York, an iron tubular frame refrigerator car for the United States Tubular Rolling Stock Co. and a snow-plow for the Utica & Black River road.

The Buffalo Car Co. in Buffalo, N. Y., has begun work on orders for 150 hopper-bottom gondolas for the Fall Brook Coal Co., to carry 25 tons each, and 150 refrigerator cars for the Merchants' Dispatch Transportation Co. A contract has just been closed with the New York, Lake Erie & Western Co. for several hundred cars, with a capacity of 25 tons each.

The parties who purchased the Anniston Car Works, in Anniston, Ala., at the assignee's sale have organized the Alabama Car Co. to operate the works.

Bridge Notes.

The Union Bridge Co., of New York, has just completed the bridge over the Arkansas River, at Van Buren, Ark., for the St. Louis & San Francisco road, which has been under construction for nearly a year past. The bridge has three fixed spans of 252 ft. each, four of 160 ft. each, and one draw span 366 ft. long.

The contract for the construction of the bridges on the Cascade Division of the Northern Pacific road, between North Yakima, Wash., and Ellensburg, has been let to Messrs. Hoffman & Bates, bridge contractors.

The office of the Boston Bridge Works has been removed to No. 70 Kilby street, Boston.

The Phenixville Bridge Works in Phenixville, Pa., have just shipped three iron bridges to the Union Pacific road. The works are running on a number of orders for bridges.

Iron and Steel.

Milton Furnace in the Hanging Rock region in Ohio, has gone out of blast for repairs.

The Sharon Iron Co. is having its blast furnace in Sharon, Pa., thoroughly repaired with the intention of putting it in blast as soon as possible.

Pequest Furnace in Warren County, N. J., will go into blast very shortly. The furnace will make Bessemer pig iron, using anthracite coal as fuel.

The Roane Iron Co. is about to make full tests of the iron ore from the Cranberry mines in North Carolina in making Bessemer pig. A large supply of the ore will be brought to the company's furnace at Rockwood, Tenn., and used for making iron. If the experiment is successful the company will probably enter upon the manufacture of Bessemer steel at its Chattanooga mill. A Siemens-Martin plant is already in use at this mill.

The Rail Market.

Steel Rails.—The market is quiet, with quotations steady at $34@$35 per ton at Eastern mills and proportionately higher at Western mills. The sales so far made for 1886 are reported at about 775,000 tons and present prospects are that considerable addition will be made to this amount. The rail manufacturers apparently have no fears of running short of work.

Rail Fastenings.—The market is active and quotations have been advanced to 2.40 cents per lb. for spikes in Pittsburgh. Track-bolts are quoted at 2.75@3 cents, and splice-bars at 1.75@2 cents.

Old Car Wheels.

We are informed that there are some cast-iron car wheels still in use on the Memphis & Charleston road which were made over 30 years ago. These wheels were cast from ore mined in Monroe County, Tenn., close to the North Carolina line.

Western Society of Engineers.

The 221st meeting was held in Chicago, Feb. 2, President Wright in the chair.

Mr. William S. Grant-Symn was elected a member. Mr. Arthur M. Kinsman was transferred from the grade of associate to that of member.

The thanks of the Society were voted to the Ohio Society of Surveyors and Civil Engineers for an invitation to attend its seventh annual meeting at Columbus, Jan. 12; and to the American Institute of Mining Engineers to attend the meeting of the Institute, to be held at Pittsburgh, Feb. 16.

The Secretary presented from the Trustees the following report:

"The trustees have, in accordance with the request made at the last meeting, taken into consideration the general interests of the Society, and are of opinion that some changes in the conduct of its affairs may be desirable. At the present time, however, the greatest need is a large increase in the number of members. If the membership can be doubled, the value and efficiency of the Society will be increased in a much greater proportion. It would seem, therefore, that the first effort should be in this direction, and that it is practicable for each of the present members to bring into the Society at least one new member. Believing that the best way to accomplish this is to make the pecuniary burden of membership as light as possible it is hereby recommended that the amounts for entrance fee and annual dues be reduced."

A full discussion of the report was had, after which it was proposed that no entrance fee shall be collected from new members after Jan. 1, 1886, and that members residing in Cook County, Ill., shall pay dues at the rate of $6 per year; all other members of every grade shall pay at the rate of $5. A resolution was adopted that the members present favored the proposed amendment.

A paper was read by Mr. Zellweger on the Cremation of Garbage.

The Secretary read a communication from Mr. Palmer, calling attention to the convention of the American Society of Mechanical Engineers, to be held in Chicago May 25 to 28, and suggesting that the Society should take some action in relation to this. It was voted that the President appoint a committee to report on this matter. Messrs. Palmer, Cregier and Gottlieb were appointed as this Committee.

A resolution was adopted that the portrait of President Wright be added to the collection of portraits of former Presidents, and requesting ex-President Williams to sit for net portrait previously voted by the Society, but not as yet ordered. The Society then adjourned.

Michigan Engineering Society.

The Michigan Engineering Society held its annual meeting in Ann Arbor, Mich., beginning Jan. 26. At the first session on that day the reports of the officers were presented and other routine business transacted, and in the evening President Angell, of the University of Michigan, made an address of welcome, and Prof. Davis, President of the Association, delivered a long and interesting address on technical education. At the close of this address a general discussion was held on this subject.

On the second day the Society divided into sections. In section A, on Surveying, papers were read by H. B. Sturtevant and H. D. Bartholmew. In section B, on Civil Engineering, papers were read by Frank P. Davis and F. J. Sager. In section C, on Mechanical Engineering, Prof. M. E. Cooley, read a paper on the Westinghouse Air Brake. In the afternoon the members visited the University, making an examination of the buildings, etc. In the evening a general session was held at which amendments were made to the by-laws and other business transacted, and several new

* Published in the *Railroad Gazette* for Jan. 8 last, page 22.

members were elected. A communication was received from the Indiana Engineering Society, suggesting that a joint committee be appointed to determine the true boundaries between the states.

On the third day, in the morning, the members visited and examined the city water-works. In the afternoon sessions were held in each of the three sections, at which interesting papers were read, including one in the mechanical section on pile drivers for railroad work, by Mr. W. L. Clemens, of Bay City. A general session was held in the evening, at which the old officers were re-elected for the ensuing year, with the addition of Mr. H. D. Bartholmew as Recording Secretary. It was decided to hold the next year's convention at Grand Rapids. At this session several very interesting addresses were made, and there was also a fine display of surveying instruments. At the conclusion of the session the Society adjourned until next year.

The Inaccuracies of Car Wheels.

The *Scientific American* contains the following remarks under the above caption. "The Inaccuracies of the *Scientific American*" would, however, be a more appropriate heading:

"At a recent meeting of master car-builders at Boston, Mass., it was stated that the 24-in. chilled iron car wheels were liable to be ¼ in. different in ranges of diameter and an equal amount in eccentricity, both variations being caused by irregularities in cooling. The sentiment of the meeting was reported to be against grinding the wheels to accuracy in concentricity and diameter, as involving a useless expense. These opinions do not seem to be warranted by an examination of the facts. The evils of uneven wear of chilled wheels are well known, and universally ascribed to skidding the wheels by excessive application of the brakes; but as such use of brakes is forbidden, and at present somewhat infrequent, is it not more probable that it is in great measure due to the enforced slip caused by fastening wheels of different diameter upon the same axle?"

A better collection of misapprehensions can seldom be found. In the first place, 24-in. wheels are very rarely used, and then only under engine tracks, where, of course, no brakes are applied. The figures as to the eccentricity, ¼-in., and the diameter, 24-in., were taken as round numbers by a mechanical engineer who took part in the discussion, but was wholly unacquainted with railroad practice. The general opinion of the meeting was decidedly in favor of grinding car wheels which were appreciably out of truth, though a resolution that all car wheels should be round was not put to the meeting. The want of practical knowledge displayed by the writer in imagining that the flat spots caused by skidding wheels could be mistaken for the flange wear caused by two wheels of unequal diameter being fastened on the same axle is refreshing to meet with, and is on a par with the comforting assurance that wheels are never skidded now, because such a heinous crime is forbidden. What a happy, idyllic, perpetual summer sort of a time we should all have if every action once forbidden was never done again.

Trial of the Rotary Snow Plow.

Fuller accounts have reached us of the performance of the Leslie rotary steam snow shovel on the Northern Iowa Division of the Chicago & Northwestern Railway, say that the machine did excellent work, going through tightly-packed drifts at the rate of from 100 to 240 ft. per minute. The drifts are said to have been extremely hard and solid, the face being more like ice than snow. The depths as measured in each case with a tape line by a gentleman detailed for that purpose by the railroad company, were from 3 to 10 ft. deep over the rails. The rotary shovel, nevertheless, threw the snow 100 to 200 ft. clear of the road. On Jan. 25 the plow cut through 27 drifts between Jewell Junction and Stratford, a distance of 15 miles. The length and height of each drift was measured by a tape line, and it was found that the total length of drifts was 20,810 ft., or about four miles. The height varied from 3 to 10 ft., about 5 ft. being an average. The time actually consumed in cutting through these drifts was 3 hours 25 minutes, being slightly over 100 ft. per minute. The whole time occupied in clearing the 15 miles of road, which had been blocked for 12 days, was nine hours, including all detentions, such as shoveling snow into tender tanks, etc. This record seems very creditable, especially as the machine is new, and the inventors were not familiar with the requirements of a Western road blocked by the exceedingly hard and solid drifts found in Iowa and the adjoining states. Some alterations in detail will be made in the form of the knives, which were adapted to cut the softer snow found in the East and Canada. These modifications are expected still further to improve the working of the plow. It is reported that the officials of the Chicago & Northwestern are highly pleased with the amount of work done in so short a time, and say that the rotary snow shovel has done in one day more than the best appliances hitherto known could effect in four or five days.

The Mack Elevated Railroad.

A new system of elevated railroad has been lately patented by Mr. W. B. Mack, of Boston, Mass. The cars are of ordinary construction as regards the bodies, and are carried on two trucks. Each truck has two main wheels in the centre of the track, and two small wheels at the side of the track. The former wheels carry most of the weight of the car, and the side wheels prevent the car upsetting. The central rail is considerably lower than the side rails. The pillars are formed of wrought-iron tubes varying from 9 in. to 6 in. diameter. The tubes are joined and braced together by suitably formed castings, provided with sockets into which the tubes are pressed or screwed. No bolts or rivets are used in these supports.

The inventor claims that many objections to previously devised systems have been overcome. The structure is symmetrical and offers almost no hindrance to street traffic. Where streets are narrow, as in Boston, the structure can be built upon the sidewalk, and will then occupy little more space than an ordinary street lamp-post. The lower pillars are 9 in. columns, set 2 ft. apart and standing ft. or more from the sidewalk level, so that they do not necessarily occupy more than 3 ft. 6 in. from the curb inwards on the sidewalk, while the space between the pillars will admit of pedestrians passing between them without any inconvenience. There being no cross ties on the top of the trestle, obstruction to light in stores and warehouses is reduced to a minimum.

In wide streets, the structure is built above the horse car lines with a single row of larger columns on each side.

THE SCRAP HEAP.

Women's Rights on the Train.

A smart young man, such as occasionally stray from home, was on the train. He made himself very conspicuous by his frantic attempts to turn over one of the seats, which was locked. As the seat did not move at his will he lost his temper, jerked at it as if he would force it whether or no, and began swearing like a trooper. There were several ladies in the car, and the language he used in expressing his opinion of the road, the conductor, the seats, and all was naturally very distasteful to them. Among the ladies were two from this city, one a young lady, the other an elderly and rather muscular lady, well known in Council Bluffs. These ladies finally got up from their seats, went to the young man, and the elderly lady, tapping him on the shoulder, said: "Sir, we have heard all the profanity we propose to hear. If you do not sit down and behave yourself I will pull the bell-rope and stop the train, and we will put you off ourselves." The young man took his seat, while some of the male passengers, clapping their hands, shouted: "That's right, auntie; we'll stand by you." The sneaky look of that fellow was the picture of meanness. There was no more trouble with him.—*Omaha Bee.*

Why He Got a Pass.

Mr. Hoyt Sherman, Jr., the U. P. passenger agent, was intercepted by a man the other day, who boldly announced:

"I want you to give me a pass to Oxford, Idaho, and return."

"Indeed; on what grounds?" asked the agent.

"On these grounds: That if I don't get the pass, I'll walk every foot of the way with my hob-nailed boots and wear your infernal ties out for you."

"What's your name, stranger?"

"Joe Rich, of Idaho."

The pass was furnished without further ado.—*Salt Lake (Utah) Herald.*

Train Wrecking by Collision.

A dispatch from Parkersburg, W. Va., Feb. 14, says: "One of the most fiendish attempts to destroy human life ever known in this vicinity occurred here at midnight last night. Engine No. 709 of the Baltimore & Ohio Railroad was standing on a switch, head east, her crew having fired her up and left temporarily. The west-bound freight was due in 30 minutes, and first setting the switch, some unknown scoundrel jumped on the engine, threw open the throttle, and then sprang off. The engine hesitated a moment and then darted away like the wind, and was soon out of sight on the main line going east. At bridge No. 50, 12 miles out, the engineer of the freight, which was running at the rate of 20 miles an hour, heard the approaching engine and whistled for the brakes, but in a moment the wild engine was upon the train, the two coming together with terrible violence. Both engines and the entire train of freight cars were dashed to pieces, every man aboard the freight being wounded. Fireman John Armsey was found under the wreck suffering from cuts and bruises on the head and shoulders, and also from internal injuries. He will die. Engineer Andrews, Conductor Bradford, and Brakeman Murray and Westbrook are all badly hurt, but will recover. How any escaped with their lives is a mystery. The perpetrator of the fiendish deed is unknown."

A Runaway Engine.

On the afternoon of Feb. 10 a locomotive standing in the Buffalo, Rochester & Pittsburgh round-house at Lincoln Park in Rochester, N. Y., suddenly and without warning started off, no one being near it, ran across the yard and off the track into the turn-table pit. The locomotive was badly damaged. The only explanation offered is that a leaky throttle valve may have allowed steam to accumulate gradually in the cylinders until a sufficient pressure was obtained to start the engine.

A Pass Used for All it is Worth.

Three or four years ago a Michigan Central Railroad train ran into a farmer's rig at a crossing and killed the old man and both horses. The old woman was found a pretty easy customer to settle with. She took $200 for the horses, $2,000 for the old man, and a life-pass in payment of her own shaking up. Within six weeks after getting the pass she went down to visit her daughter, near Chicago, and two days afterward returned to her sons, near Detroit. Since that date she has used the pass regularly four times per week, or a matter of 800 times. Travel seems to benefit her, and she expects to put in at least ten years more of life.—*Wall Street News.*

A Lost Car.

It is not often that a car is lost out of a train without the fact being discovered by some of the trainmen, but such was the case on the Northern Central last week one night. One of the cars in a freight train coming north was derailed near Grover station, and became uncoupled at both ends and left the track. The trainmen soon after discovered that the train had parted and the engine was stopped and coupled up and came on to Elmira, without the men being aware that one care had been lost. The car was discovered by the conductor of another train.—*Elmira (N. Y.) Advertiser.*

Railroad Young Men's Christian Association.

The branch of the association established in Atlanta, Ga., a little over a year ago, reports a fair degree of prosperity during 1885—its first working year. The financial condition is good, the receipts for the year having been $1,889, while the present resources exceed all outstanding liabilities. The money contributed has not only met all current expenses, but enabled the Association to furnish its rooms with all necessary furniture, book cases and an organ. The Devotional Committee reports that 70 religious meetings have been held, with a good attendance, and a bible class has been carried on throughout the year. The Entertainment Committee reports that 11 entertainments were given, with an average attendance of about 150, besides 2 lectures.

The reading room is supplied with a number of daily, weekly and technical papers and magazines, and 220 volumes have been thus far given to the library. The total attendance at the Association rooms, for all purposes, was registered at 10,299. The Association issues a very neat monthly paper, containing a good deal of information in a condensed form, and this paper is very appropriately made up in imitation of the folders issued by so many railroad companies to advertise their roads. This appropriate imitation is also carried out in the membership ticket, which is made in imitation of a railroad coupon ticket, good for one first-class passage to stations indicated; the stations mentioned on the attached coupons being each of them one of the entertainments or lectures to be given at the Association rooms.

The Association at Milwaukee, Wis., in its monthly paper called *Sparks* reports its continued prosperity. The meetings have been well attended, and the membership is growing. Besides the religious meetings, notices are given of a lecture or other entertainments to be held during February, and this branch is evidently in an active working condition.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago, St. Louis & Pittsburgh, annual meeting, in the Union depot in Indianapolis, Ind., March 17.

Delaware, Lackawanna & Western, annual meeting, at the office in New York, Feb. 23.

Housatonic, annual meeting, at the office in Bridgeport, Conn., Feb. 26.

Illinois Central, annual meeting, at the office in Chicago, March 10.

Lehigh Coal & Navigation Co., annual meeting, at the Board of Trade rooms in Philadelphia, at 11 a. m., on Feb. 23.

Missouri Pacific, annual meeting, at the office in St. Louis, at 9 a. m., on March 9. Transfer books close Feb. 6.

New Orleans & Northeastern, annual meeting, at the office in New Orleans. March 1.

Norfolk Southern, annual meeting, at the office in Elizabeth City, N. C., March 4.

Pennsylvania Railroad, annual meeting, at Musical Fund Hall in Philadelphia, at 11 a. m., on March 9.

Peoria, Decatur & Evansville, annual meeting, in Peoria, Ill., March 2.

St. Louis & Cairo, special meeting, to vote on the question of leasing the road to the Mobile & Ohio, in New York, March 15.

Wabash, St. Louis & Pacific, annual meeting, at the office in St. Louis, March 9.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago, Burlington & Quincy, 2 per cent., quarterly, payable March 15, to stockholders of record on Feb. 20.

Delaware & Round Brook (leased to Philadelphia & Reading), 2 per cent., quarterly, payable Feb. 16.

Iowa Falls & Sioux City (leased to Illinois Central), 1¾ per cent., quarterly, payable March 1, to stockholders of record on Feb. 15.

Railroad and Technical Conventions.

Meeting and conventions of railroad associations and technical societies will be held as follows:

The *National Association of General Passenger & Ticket Agents* will meet in Chicago, on Tuesday, March 16.

The *Southern Time Convention* will hold its spring meeting at the Grand Hotel in Cincinnati, on Wednesday, April 14.

The *General Time Convention* will hold its spring meeting at the Grand Hotel in Cincinnati, on Wednesday, April 14.

The *American Society of Mechanical Engineers* will hold its next meeting in Chicago, on Tuesday, May 25.

The *Master Car-Builders' Club* will hold its regular monthly meetings through the winter at the rooms, No. 113 Liberty street, New York, on the evening of the third Thursday in each month.

The *New England Railroad Club* will hold its monthly meetings at its rooms in the Boston & Albany passenger station in Boston, on the evening of the second Wednesday in each month.

The *Western Railway Club* will hold its regular monthly meetings at its rooms, No. 103 Adams street in Chicago, on the third Wednesday in each month.

Baltimore & Ohio Employes' Relief Association.

The January sheet of this association shows the payments of benefits during the month as follows: Main Stem, Transportation Department, 120; Machinery Department, 104; Road Department, 72; Baltimore & Philadelphia, 4; Trans-Ohio Division, 113; Pittsburgh Division, 80; Physicians' bill, 88; total, 581. The largest single payment was $1,000 to the widow of J. W. Crabill, brakeman, accidentally killed.

New York City & Northern Employes' Mutual Benefit Association.

The New York City & Northern Mutual Benefit Association reports for the year ending Dec. 31 last total receipts amounting to $1,667. Payments amounted in all to $1,399, leaving $268 cash on hand. Weekly benefits amounting to $648 were paid to 35 sick and injured members. The physician employed by the Association treated during the year 202 cases, 27 of which were the result of injury, and the total cost of medical attendance was $747.

The membership of this association is confined to employés and officers of the New York City & Northern road, and its funds are derived from a regular assessment of 50 cents a month on each member, with a special assessment of 50 cents in case of death of a member. No deaths were reported last year, the receipts, with the exception of $13 from donations, being entirely from the monthly dues paid by members.

ELECTIONS AND APPOINTMENTS.

Associated Roads of Kentucky, Tennessee and Alabama.—The following circular is signed by the representatives of the Cincinnati, New Orleans & Texas Pacific, the East Tennessee, Virginia & Georgia, the Louisville & Nashville, the Mobile & Ohio and the Nashville, Chattanooga & St. Louis roads:

"Mr. James R. Ogden has been appointed Commissioner under the contract dated at New York, Dec. 10.

"Mr. Ogden will assume the duties of the position, and exercise the authority delegated by the contract, on and after this date.

"All orders issued by him relating to the establishment, adjustment and maintenance of rates upon and division of computative freight traffic must be obeyed."

Boston Passenger Committee.—The officers of this new organization are: President, A. S. Hanson, Boston & Albany; Secretary, N. E. Weeks, *Pathfinder Guide.*

Burlington, Cedar Rapids & Northern.—Mr. George A. Goodell has been appointed Assistant Superintendent of the Second, Third and Fourth divisions, vice J. C. Fox, resigned. Mr. W. P. Ward succeeds Mr. Goodell as Superintendent of Telegraph and Train Dispatcher.

Chicago, Burlington & Northern.—Mr. David Coleman is appointed Superintendent in charge of Northern Division, with office at La Crosse, Wis. During construction Mr. Coleman will also have charge of tracklaying and construction work generally on Southern Division. Mr. C. A. Goodnow is appointed Assistant Superintendent of Northern Division, with office at La Crosse, Wis. Mr. J. M. Barr is appointed Assistant Superintendent of Southern Division, with office at Savanna, Illinois.

Cincinnati, Indianapolis, St. Louis & Chicago.—Col. Orland Smith, of Cincinnati, has been chosen a director in place of J. A. Fay, of Boston, resigned.

Cincinnati, New Orleans & Texas Pacific.—At the annual meeting in Cincinnati, Feb. 15, the old directors were re-elected, as follows. Frank S. Bond, T. T. Gaff, W. A. Goodman, Alexander McDonald, Charles Schiff, Briggs Swift, Augustus Wessel, Cincinnati; Isaac P. Martin, Otto Plock, New York.

The board subsequently re-elected Frank S. Bond President; Charles Schiff, Vice-President; H. H. Tatem, Secretary and Treasurer.

Denver & Rio Grande Western.—Mr. J. H. Bennett has been appointed General Agent at Denver, Col., and will have charge of all business of the company in Colorado.

East Tennessee, Virginia & Georgia.—Mr. T. S. Davant has been appointed General Freight Agent in place of Mr.

James R. Ogden, now Commissioner of the new Southern pool.

Elgin, St. Charles & Southern.—The directors of this new company are: Edward H. Bowman, Nathan S. Carlisle, Charles H. Haines, James M. Robinson, Henry T. Rockwell, J. B. T. Wheeler, St. Charles, Ill.; George S. Bowen, Elgin, Illinois.

Erie Dispatch.—The following will be the present organization of this fast freight line, which includes all the lines operating over the New York, Lake Erie & Western Railroad: Geo. W. Ristine, General Manager, Chicago; S. H. Wenck, Auditor, New York; Edward White, Treasurer, New York.

The list of Agents of the line is as follows: Akron, O., S. Durano; Albany, N. Y., W. E. Keating; Boston, H. H. Marshall, New England Agent, *via* Fitchburg Railroad, 268 Washington street; A. Cushman, Foreign Freight Agent, via Fitchburg Railroad, 53 State street; Burlington, Ia., J. C. Lewis; Chicago, Frank Bier e, E. & P. D. Div.; Jas. Sharpe, G. W. D. Div.; W. H. Hogan, S. S. L. Div.; Cincinnati, W. H. Tennis; Cleveland, O., W. B. Wetherell; Columbus, O., E. A. Fitch; Dayton, O., Chas. Chamberlin; European Freight Agents, G. H. Fletcher & Co., Mersey Chambers, Liverpool, England; Evansville, Ind., R. K. Dunkerson; Indianapolis, Ind., W. C. Lynn, Agent G. W. D. and E. & P. D. divisions; J. W. Smith, Agent S. S. L. Div.; M. S. E. Robinson, Traveling Agent; Kansas City, Mo., C. C. Chamberlain; Louisville, Ky., Thos. Satterwhite; Mauch Chunk, Pa., T. B. Koons; Memphis, Tenn., J. H. Steiner; Minneapolis, Minn., G. J. Borup; New York, N. Y., T. L. Hanna, General Agent, M. W. DeWolf, Agent, 401 Broadway, Edward Foley, Foreign Agent, 4 Broadway; Peoria, Ill, Frank Baker; Philadelphia, T. J. Klase; Rochester, N. Y., W. S. Taylor; St. Paul, Minn., G. J. Borup; St. Louis H. L. Rountree, E. & P. D. and S. S. L. divisions; C. L. Dean, G W. D. Division; Toledo, O., J. C. Morse; Urbana, O., C.W Clarke.

Florida Railway & Navigation Co.—Mr. F. B. Papy, long General Freight Agent, has been appointed Traffic Manager, with office at Jacksonville, Florida.

Fort Smith & Southern.—The directors of this new company are: B. Baer, James Brezzolara, W. M. Fishback, Charles Hall, Fort Smith, Ark.; D. H. Nichols, John O'Day, Springfield, Mo.; A. Douglas, James Dunn, St. Louis.

Gettysburg & Harrisburg.—Mr. J. P. Heindall has been appointed Assistant Superintendent of this road.

Havana, Rantoul & Eastern.—Mr. C. O. Shepherd, heretofore Auditor and Cashier, has been appointed Auditor and General Freight Agent of this road.

Immigrant Clearing House.—The following circular has been issued, signed by Mr. S. F. Pierson, Chairman: "Mr. C. F. Doane has been appointed Joint Agent and Joint Ticket Agent at Castle Garden, New York, in charge of immigrant business and the sale of immigrant tickets; the appointment to date from Feb. 1, 1886."

The Board of Commissioners of Emigration of the State of New York at their last regular meeting, Jan. 28, unanimously adopted the following resolution relative to the appointment of Mr. Doane:

"*Resolved*, That the Board cordially approves of the appointment of Mr. C. F. Doane as Joint Agent of the Trunk Lines in Castle Garden, and heartily congratulates the Trunk lines in so good and wise a selection."

Jackson Southern.—The directors of this new company are: H. J. Bailey, P. H. Berger, John K. Brown, J. W. Cowing, A. Feddis. Office in Jackson, Minnesota.

Kentucky Central.—Receiver H. C. Huntington has issued a circular announcing the following appointments: C. L. Brown, General Freight Agent; S. F. B. Morse, General Passenger Agent; L. B. Lewis, Jr., Auditor; L. B. Enslow, Cashier; Epes Randolph, Superintendent of Road Department; S. R. Tuggle, Master Mechanic; W. S. Maynard, Chief Train Dispatcher.

Lowell & Andover.—This company, whose road is leased to the Boston & Maine, has elected Frederick Ayer, President; Benjamin Walker, Secretary.

Manitoba Southwestern.—At the annual meeting in Winnipeg, Manitoba, Feb. 3, the following directors were elected: D. A. Smith, R. B. Angus, W. C. Van Horne, J. M. Egan, J. A. M. Aikens, J. S. Aikens, D. M. Tillford, J. H. McTavish, C. V. Howell. The officers elected are: Hon. D. A. Smith, President; J. M. Egan, Vice-President; J. H. Vanzile, Secretary.

Mobile & Ohio.—The following circular has been issued by Vice President Talcott: "Mr. J. G. Motley, General Superintendent, is relieved from the duties of Superintendent of the Southern Division heretofore performed by him, and until further orders will be assisted by a superintendent on that division. Mr. J. W. Fry has been appointed Superintendent, and will take charge of the Southern Division, assisted by W. O. McMahon, Master of Transportation. Major E. S. Horsford will remain in charge of the Northern Division, assisted by E. M. Wallace, Master of Transportation."

New York Central & Hudson River.—Mr. M. C. Roach, late General Agent at Buffalo, has been appointed General Eastern Passenger Agent, with office in New York, in place of Mr. C. F. Doane, who has taken charge of the Trunk Lines immigrant agency in that city. Mr. Edson J. Weeks is appointed General Agent of the Passenger Department in Buffalo, to succeed Mr. Roach. Mr. Weeks has been for some time agent for the West Shore road at Buffalo.

New York City & Northern Employés' Mutual Benefit Association.—The officers chosen at the recent annual meeting are: President, Thomas Millen; Vice-President, W. D. Davies; Secretary, C. P. Curtis; Corresponding Secretary, L. J. Maher; Treasurer, Frank S. Gannon; Executive Committee, M. W. Maguire, H. C. Moore and E. E. Gannon.

Ohio & Mississippi.—Mr. E. P. Cutter is appointed Auditor of this company.

Ontario & Pacific Junction.—At the annual meeting recently the following directors were chosen: George A. Cox, Peterboro, Ont.: J. M. Ferris, Campbellford, Ont.; John Bell, Belleville, Ont.; A. Baxter, Wm. Gooderham, Robert Jaffray, Edmund Wragge, Toronto, Ont.; J. Burton, Joseph Hickson, Montreal.

Philadelphia & Erie.—At the annual meeting in Philadelphia last week the following directors were chosen: J. N. Du Barry, Wm. L. Elkins, Wm. J. Howard, Wistar Morris, N. Parker Shortridge, Edmund Smith, Samuel Gustine Thompson, Henry D. Welsh, John P. Wetherill, W. Hasell Wilson.

St. Paul, Minneapolis & Manitoba.—Mr. S. J. Beals has resigned as Claim Agent, but will continue as Assistant Auditor, which position, in connection with the first named, he has been filling for some time past. Mr. C. B. Yale, who has been in the claim department of the Chicago, Milwaukee & St. Paul for five years past, has been appointed Claim Agent, to succeed Mr. Beals.

Scioto Valley.—At the annual meeting in Columbus, Feb. 11, the following directors were chosen: W. W. Franklin, Columbus, O.; Marcus Boggs, Chillicothe, O.; George Davis, Portsmouth, O.; John Groyce, Circleville, O.; Dill Wiegand, South Bloomfield, O.; George H. Davis, Horace Porter, George Watkins, Edward F. Winslow, New York.

Zanesville & Ohio River.—At a meeting held Jan. 27 the following directors were chosen: E. M. Stansbery, McConnellsville, O.; James Buckingham, Wm. A. Graham, Wm. S. Harlan, Francis Wedge, John W. Pinkerton, Edward A. Greene, Albert E. Boone, Zanesville, O.; E. T. Barker, Morton McMichael, George Maves, J. L. Welsh, Philadelphia; Chase Andrews, Washington. The board elected Jas. Buckingham President; Wm. S. Harlan, Secretary; Richard Peters, Jr., of Philadelphia, Treasurer.

PERSONAL.

—Mr. R. H. Parks, for 10 years past President of the St. Charles Car Co. in St. Charles, Mo., has resigned that position in order to go into other business.

—Mr. John Jacob Crouse died suddenly in Syracuse, N. Y. Feb. 12, aged 52 years. He was for some years a prominent business man and banker in that city and leaves a large fortune. He was a director of the Utica & Black River Railroad Co., and was also interested in local railroad enterprises.

—Mr. Edward Benton Talcott died in Chicago, Feb. 7. He was born in Rome, N. Y., in 1812 and removed to Chicago, in 1835. He was a civil engineer by profession and was employed in the construction of a number of the older Chicago roads, and was for some time City Engineer of Chicago. For some years past he has not been actively engaged in business.

—Mr. John B. Slawson died in New York, Feb. 12, aged 72 years. Mr. Slawson was for a number of years a large stockholder and Treasurer of the John Stephenson Car Co. so widely known as builders of horse cars. Mr. Slawson was the inventor of the Slawson fare-box which is almost universally used in horse cars where no conductors are employed and from which patent he derived a considerable income.

—Mr. William S. Sneden, recently appointed Superintendent of the Southern Division of the Jacksonville, Tampa & Key West road, in Florida, was for many years connected with the New Jersey Southern road as General Superintendent, at one time Receiver, and as General Manager. He was also Chief Engineer of the New York & Long Branch road, and was very successful in the management of these lines.

TRAFFIC AND EARNINGS.

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

Month of January:	1886.	1885.	Inc. or Dec.	P.c.
Boston, Hoosac Tun. & W....	$38,356	$32,222	I. $6,134	18 2
Bur., C. R. & No.	177,563	223,719	D. 46,156	20.6
Char., Col. & A..	60,491	77,940	D. 17,449	22.3
Cin., W. & Balt..	144,522	154,784	D. 10,262	6.2
Cleve., Ak. & C..	32,638	31,791	I. 847	2.9
Col. & Greenville	53,984	71,706	D. 17,722	24.6
Denver & R. G...	404,424	405,341	D. 917	0.2
Ev. & T. Haute..	51,177	51,423	D. 246	0.5
Ft. Worth & D..	24,650	22,718	I. 1,932	8.4
Ill Central:				
Ill. lines	452,716	508,607	D. 55,891	11.0
South. Div. ..	317,984	407,350	D. 94,366	23.2
Iowa lines. ...	88,300	102,603	D 15,363	14 7
Ind., Dec & Spr.	35,999	30,487	I. 5,512	18.1
K. C., Clinton & Springfield	12,780	.....	.....	....
K. C., Ft. S. & G.	183,402	220,610	D. 37.208	16.8
K. C., Spr. & M..	88,745	150,054	D. 61,309	40.9
L., N. O. & Tex..	156,031	97,503	I. 58,528	60.0
Marq., H. & O..	21,519	15,671	I. 5,848	36.6
N. Y., Ont. & W.	82,956	83,353	D. 397	0.5
Ohio Southern...	44,790	45,109	D. 319	0.7
Oreg. R. & N. Co.	201,873	191,692	I. 10,181	5.3
Peoria, Dec. & E.	53,963	61,275	D. 7,312	11.9
Rich. & Dan	276,800	325,100	D. 48,300	14.9
St. Jo. & Gd. I.	52,742	86,766	D. 34,024	39.1
St. L., A. & T. H.				
Main Line.....	89,256	97,267	D. 8,011	8.3
Belleville Line.	59,040	58,262	I. 778	1.3
Texas & Pacific..	429,000	342,000	I. 87.000	25.4
Texas & St. L...	103,395	63,899	I. 39 496	61.7
Va. Midland	84,606	98,582	D. 13,976	14.1
Wab., St. L. & P.	814,246	1,053,319	D. 239,073	22.7
Western N. C....	34,189	33,865	I. 324	1.0
Wisconsin Cent..	92,728	101,659	D. 8,931	8.8
First week in February:				
Buff., R. & Pitts.	$23,397	$18,261	I. $5,136	28 5
Canadian Pac....	101,000	92,000	I. 9,000	9.8
Chi. & Alton....	136,766	135,095	I. 1,671	1.3
Chi. & Nor'west.	345,300	356,700	D. 11,400	3.2
C., St. P., M. & O.	88,200	82,000	I. 6,000	7.3
C., I., St. L. & C.	47,647	43,000	I. 4,647	10.8
Det., Lan. & No.	14,991	14,923	I. 68	0.4
Denver & R. G...	98,793	98,826	D. 33	....
Illinois Central..	202,500	243,238	D. 40,738	16.7
Iowa lines.....	27,400	27,354	I. 46	0.2
Long Island.....	36,686	44,038	D. 7,352	16.7
Louisv. & Nashv.	240,055	275,235	D. 35,180	12.8
Mil. & Northern.	9,775	9,550	I. 225	2.4
Second week in February:				
Chi. & East. Ill..	$12,682	$17,292	I. $15,390	89.8
Chi., Mil. & St. P.	372,000	273,390	I. 98,610	31 5
Mil., L. S. & W..	25,080	14,965	I. 10,115	67.4
St. L. & San F...	67,900	60,200	I. 7,700	12.8
Year ending Dec. 31:	1885.	1884.		
Bur., C. R. & No.	$3,093,514	$2,796,459	I. $297,055	10.6
Net earnings..	903,972	878,690	I. 25,282	2.9
Canadian Pac...	8,368,493	5,750,522	I. 2,617,971	45.5
Net earnings...	3,225,216	1,191,890	I. 2,033,336	170.6
Denver & R. G....	6,119,053	5,552,103	I. 566,950	10.2
Net earnings...	2,183,780	1,793,573	I. 390,207	21.8
Ft. Worth & D..	464,456	463,568	I. 888	0.2
Net earnings...	192,390	214,708	D. 22,318	10.4
N. Y., Sus. & W.	1,092,354	1,034,208	I. 58,146	5.6
Net earnings...	474,834	416,520	I. 58,314	14.0
Oregon R. & N. Co.	5,102,737	4,308,341	I. 794,396	18.4
Net earnings..	2,306,512	1,764,038	I. 542,474	31.3
Month of December:				
Bur., C. R. & No.	$266,909	$288,451	D. $21,542	7.5
Net earnings...	48,347	104,137	D. 55.790	53.7
Canadian Pac. ..	729,935	521,552	I. 208,383	39.9
Net earnings...	241,033	171,315	I. 69.718	40.8
Den. & R. G.... ..	504,179	421,358	I. 82.821	19.7
Net earnings...	197,149	110.194	I. 86,955	79.0
Ft. Worth & D..	33,361	25,684	I. 7.677	29.6
Net earnings...	6,202	13,285	D. 7,083	53.2
Maine Central...	217,000	202,000	I. 15,000	7.4
Net earnings...	52,000	55 000	D. 3,000	5.5
Oreg. R. & N. Co.	492,450	252,035	I. 240.415	95.4
Net earnings ..	195,446	7,591	I. 187,855	....

Weekly earnings are usually estimated in part, and are subject to correction by later statements. The same remark applies to early statements of monthly earnings.

Coal.

Coal tonnages for the week ending Feb. 6 are reported as follows:

	1886.	1885.	Inc or Dec.	P.c.
Anthracite	552,541	458,158	I. 94,383	20.6
Eastern bituminous.....	173,676	153,273	I. 20,403	13.4
Coke.....	24,946	48,143	D. 23,197	48.3

Much interest is felt in the Reading reorganization proceedings, which are likely to affect seriously the question of regulating the anthracite coal trade.

Coke shipments for the week show the effect of the labor troubles in the Connellsville region, which have much reduced production.

Pennsylvania Railroad coal tonnage for the week ending Feb. 6 was:

	Coal.	Coke.	Total.	1885.
Line of road..... ...	153,575	24,001	177,576	176,434
From other lines	90,657	945	91,602	64,165
Total..... ...	244,232	24,946	269,178	240,599
Year to Feb. 7.....1,137,306		243,444	1,380,750	1,201,584

Increase for the week, 28,579 tons, or 11.9 per cent.; increase for the year, 179,166 tons, or 14.9 per cent.

The Philadelphia *Ledger* of Feb. 16 says: "We learn that the percentages of the bituminous coal pool for the season of 1886-87 have been arranged, and will be made public officially at a meeting of the representatives of the several carrying companies to be held in this city in a day or two. The tonnage to be pooled consists of all soft coal shipped over the piers at tidewater on the Atlantic coast. The Norfolk & Western and the Chesapeake & Ohio railroads will be awarded 500,000 tons each, and of the total shipments for the season, after the deduction of the 1,000,000 tons given to the two companies named, the Pennsylvania Railroad will obtain 55 per cent. and the Baltimore & Ohio Railroad 45 per cent. The tonnage of the Beech Creek and Lehigh Valley Railroads is not included in the tide or pool shipments, it having been arranged that the bituminous coal of these companies will be disposed of on the lines or by the inland connections of these roads. All shipments going over the piers at Hoboken, N. J., South Amboy, N. J., Greenwich, Philadelphia, Canton and Locust Point, Baltimore and Newport News and Norfolk, Va., will be included in the pool tonnage. The total amount pooled last year was 3,300,000 tons."

Cumberland coal shipments for the week ending Feb. 20 were 29,598 tons. Total to Feb. 13 this year, 225,573; last year, 217,306; increase, 8,267 tons, or 3.8 per cent.

The coal tonnage of the Pennsylvania Railroad for the week ending Feb. 13 was:

	Coal.	Coke.	Total.	1885.
Line of road....	160,396	27,041	187,437	167,341
From other lines.	90,285	1.107	91,392	67,070
Total.	250,681	28.148	278,829	234.411
Year to Feb. 13..1,387,987		271,592	1,659,579	1,435,995

Increase for the week, 44,418 tons, or 19.0 per cent.; increase for the year, 223,584 tons, or 15.1 per cent.

Anthracite Coal Tonnage.

The statement of anthracite coal tonnage for January, as prepared by Mr. John H. Jones, the Official Accountant, is as follows, the statement including the entire production of anthracite coal, excepting that consumed by employés and for steam and heating purposes about the mines:

	1886.	1885.	Increase.	P. c.
Philadelphia & Reading..	700,173	601,970	98,203	16.3
Lehigh Valley	446,497	340,745	105,752	31.0
Del., Lack. & West... ...	496,760	238,420	258,340	108.0
Del. & Hud. Canal Co	313,086	164,997	148,089	89.7
Pennsylvania Railroad...	237,524	208,599	23,922	11.4
Pennsylvania Coal Co ...	83,586	64.205	19.581	30.5
N. Y., L. E. & W.....	65,648	23,067	42,581	18.5
Total.....	2,338,271	1,641,803	696,468	43.0

The stock of coal on hand at tide-water shipping points, Jan. 31, 1886, was 779,004 tons; on Dec. 31, 1885, 754,545 tons; increase, 24,459 tons, or 3.3 per cent. during the month.

Southwestern Railway Association.

The earnings on traffic in this association for January are reported as follows:

East-bound.....	$164,397
West-bound	264.8 6
Lumber traffic.....	40,265
Total....	$469 488

The Chicago & Alton, the Rock Island and the Hannibal & St Joseph were over their proportions, the other roads being short.

Western Weighing Association.

During January the Western Weighing Association weighed 38,169 cars of freight, against 54,907 cars in December, and 36,156 cars in January, 1885.

Transcontinental Association.

The meeting of this association in New York last week closed on Feb. 12, but there was no definite action taken and no conclusion reached as to new division of business, or, indeed, as to any other of the points in dispute.

The representatives of the railroads in the association met again in New York, Feb. 16. The special committee, which was charged with the duty of preparing division of traffic for both passenger and freight business for the current year, reported that it had been unable to make a division satisfactory to all parties and had referred the matter back to the association. The question of divisions was discussed through the whole of the session, but no conclusion was reached.

The discussion continued on Feb. 17, but without result, and the meeting finally adjourned without reaching any agreement or providing for the continuance of the contract, thus virtually breaking up the Association.

One result of this is that notice has been sent to the Pacific Mail Steamship Co. that the monthly subsidy payment heretofore made to it by the railroad lines will be discontinued.

Cotton.

Cotton movement for the week ending Feb. 12 is reported as follows, in bales:

	1886.	1885.	Inc. or Dec.	P. c.
Interior markets:				
Receipts....	49,597	36.811	I. 12,786	34.0
Shipments....	64.494	52,556	I. 11.938	22.5
Stock, Feb 12..	454,116	256,045	I. 198,071	77.4
Seaports:				
Receipts..	105,792	68,321	I. 37,171	53.9
Exports	104,960	84,745	I. 20.215	23.8
Stock, Feb. 12.....1,044,762		836,602	I. 208,160	24.9

The total shipments from plantations for the crop year (from Sept. 1) to Feb. 12 are estimated at 5,502,921 bales; against 5,110,706 last year, 5,012,302 in 1883-84, and 5,574,576 bales in 1882-83.

Boston Passenger Committee.

A meeting was held in Boston, Feb. 10, at which it was decided to form an organization to be known as the Boston Passenger Committee. It consists of the general passenger agents of the roads terminating in Boston, and its object is to establish uniform rules and conditions for transaction of excursion and special passenger business and to attend to other matters pertaining to the passenger department which may be of general interest to the roads terminating in Boston.

The organization is not intended to interfere in any way with the New England Association of General Passenger Agents, but only to take charge of such matters as belong especially to the Boston lines, and which in reality do not properly interest the roads outside of Boston. The lines at present represented in the committee are the Boston & Albany, the Boston & Lowell, the Boston & Maine, the Boston, Revere Beach & Lynn, the New England and the Old Colony. The Boston & Providence and the Fitchburg are not yet connected with the committee, but it is expected that they will unite with it before long. Mr. A. S. Hanson, of the Boston & Albany, is Chairman, and Mr. N. E. Weeks, of the *Pathfinder Guide*, is Secretary.

Erie Despatch.

The following circular from General Manager George W. Ristine is dated Chicago, Feb. 1 :

"In accordance with the agreement of the Presidents of the Trunk Lines, dated Oct. 1, 1885, wherein it was decided to reduce the number of the fast freight lines to the lowest possible limit, it was decided, after full conference and consideration of the ques ion by the lines in interest, at meetings held in New York on Jan. 6 and 28, 1886, to consolidate, on Feb. 1, 1886, the following fast freight lines, operating over the New York, Lake Erie & Western Railroad, viz: Great Western Dispatch, Erie & Pacific Despatch, Erie & New England Line, South Shore Line; Erie & Boston Line, Waverley Line and the Union Despatch into one line, to be called the Erie Despatch, subdivided into the following divisions: Great Western Despatch Division; Erie & Pacific Despatch Division, and the South Shore Line Division, and such other divisions as may hereafter be created."

Northwestern Traffic Association.

The tonnage and earnings from the traffic covered by this Association (Chicago-St. Paul) are reported as follows, for the two months December and January:

West-bound:		C., M. & St. P.	C. & N. W.	C., R. I. & P.	C., B. & Q	Total.
Tons	1885-86	12,609	11,650	13,933	4,534	39,726
Earnings	1885-86	$74,641	$64,627	$59,743	$20,113	$219,124
	1884-85	69,379	61,702	46,572	14,357	192,010
P. c. of total	1885-86	34.0	29 5	27.3	9.2	100.0
	Allotted	34¾	30¾	21½	13.0	100.0

East bound:		C., M. & St. P.	C., St. P., M & O.	M & St. L.	Total.
Tons	1885-86	4,881	7.340	8,215	20,436
Earnings	1885-86	$18,917	$23 586	$27,285	$69 788
	1884-85	66,901	59.580	53,198	179,679
P. c. of total	1885-86	27.1	33.8	39.1	100 0
	Allotted	36	32½	31½	100.0

Wheat milled at local points :

	C., M. & St. P.	C., St. P., M. & O.	M. & St. L.	Total.
Tons	6,587	14,701	526	21,814
Earnings*	$16,293	$33,019	$1,290	$50,602
P. c. actual	32.2	65 3	2.5	100 0
P. c. allotted	72½	16½	11	100.0

* Less 30 per cent.

The most noticeable fact here is that while the earnings on west-bound traffic increased from $192,010 last year to $219,124 this, the earnings on east-bound traffic decreased from $179,679 last year to $69,788 this.

Colorado-Utah Association.

The earnings from the traffic covered by the Association were as follows last December :

Roads.	West bound.	East-bound.	Total.
C. & A	$6,824.32	$2,302.90	$9,127.72
C., B. & Q	13,134.28	7,669.83	20,804.01
C., M. & St. P	1,950.31	607.04	2,557.35
C. & N. W	5,975.11	290.15	6,265.26
C., R. I. & P	11,209.23	485.41	11,694.64
Missouri Pacific	2,147.83	159.64	2,307.47
W., St. L. & P	4,884.37	556.56	5,440 93
Totals	$46,125.85	$12.071.53	$58,197.38
C., St. P., M. & O	22.39	18.17	4 .56
H. & St. J	29 00		29.00
St. L. & S. F	583.17	30.00	613.17
Grand totals	$46,760.41	$12,119.70	$58,880.61

The traffic is that of the roads named east of the Missouri River to and from Colorado and Utah. Three roads have carried more than their allotted shares, to the aggregate value of $10,300, of which $4,868 is due by the Burlington, $3,250 by the Rock Island, and $2,182 by the Chicago & Alton.

The largest shortages are $3,708 by the Milwaukee & St. Paul and $2,387 by the St. Louis & San Francisco.

Central Passenger Committee.

The Central Passenger Committee met in Cleveland, O., Feb. 16, with a large attendance. The principal question brought up on the first day was the objection made by some of the lines to the chair cars in which other lines carry passengers without additional charge. After a long discussion it was agreed that after March 1 an extra charge should be made for passage in these cars of ¼ cent per mile, no charge to be less than 25 cents. Special rates to a number of meetings and conventions to be held during the spring and summer were agreed upon.

At the second day's meeting there were general accusations of rate-cutting, and an animated discussion followed, which closed by the passage of a resolution to abolish "order books" and orders for the sale of tickets at reduced rates.

Pacific Coast Association.

The earnings in January last from the traffic covered by this Association were :

Roads.	East-bound.	West-bound.	Totals.
C & A	$201.26	$4,464.61	$4.665.87
C., B. & Q	1,018.15	6,665.97	7,684.12
C., M. & St. P.	1,143 82	6,5..8.42	7,702.24
C. & N. W	2.178 8'	10.399.11	12,577.93
C., R. I. & P	248.03	7,858.09	8,106.12
M. P	180.13	3,407.58	3,587.71
W., St. L. & P	474.23	1,714.64	2,188.87
Totals	$5,444.44	$41,068.42	$46,512.86

The traffic covered is the Pacific coast business over the above roads east of the Missouri River.

RAILROAD LAW.

Employes' Relief Associations in Massachusetts.

The Massachusetts Railroad Commission has submitted to the Railroad Committee of the Legislature the following brief and simple bill:

"Section 1. Any railroad corporation operating a railroad or portion of a railroad in this state may, by vote of its directors, associate itself with any persons in its employ in forming a relief society under the provisions of chapter 244 of the acts of 1882, and may from time to time aid such society by giving money to it or otherwise. And the by-laws of such societies shall provide for the manner in which the railroad corporation shall vote and be represented in said society.

"Section 2. The funds of such relief society shall not be liable to attachment, trustee process, execution, or any other process, legal or equitable, because of any debt or liability of the railroad corporation, or any member of the society."

The bill was advocated by President Choate, of the Old Colony, and others, and will probably be presented to the Legislature and passed, without much change.

Injury to Employe—Negligence.

In the case of Crockett against the Burlington & Missouri River Co., the Nebraska Supreme Court holds as follows :

Where the under boss of a gravel train gang was directed by his immediate superior to take men and dig out a car which had been partly covered and derailed by a fall of gravel from a high bank near by, and in pursuance of such order did proceed to dig out the car, and while so employed was killed by the embankment caving in. Prior to that time the custom had been to station a watchman to give notice to the workmen of danger from the falling bank, which was omitted on that occasion. *Held*, that the company was liable.

2. The conductor of a gravel train on a railroad with a gang of men under his immediate control in the employ of the railroad company, is, as to such men, the vice principal of the railroad company, and not a fellow-servant.

3. A sub-boss under the immediate control and direction of the conductor, or the person in charge of a gravel train, is not, as to such conductor, or person in charge of the train, a fellow-servant.

The Pennsylvania Constitution and Railroad Charters.

The Pennsylvania Supreme Court on Feb. 15 rendered decisions in two important railroad cases, which have been pending for over a year. They are the Pennsylvania Railroad Co. *versus* Duncan, and the Philadelphia & Reading Railroad Co. *versus* Patent.

In the first case the Court agrees to the argument of the counsel for the plaintiff in error, concerning inviolability of the company's charter, the principle enunciated by the United States Supreme Court in the Dartmouth College case, and the fact that framers of the constitution of 1874 did not intend to violate the Federal Constitution. "Nevertheless," continues the opinion, "it seems to us as of no avail to deny the plain and obvious reading of the eighth section, article 16, of the present constitution : 'Municipal and other corporations and individuals invested with the privilege of taking private property for public use shall make just compensation for property taken, injured or destroyed by the construction or enlargement of their works, highways or improvements, which compensation shall be paid or secured before such taking, injury or destruction.'"

It is admitted that the other existing municipal corporations were covered by that provision, and the Court cannot comprehend the force of the reasoning that would exclude other corporations. Stress is laid upon the significance of the word "invested," and here the opinion says : "Thus, while we have no doubt of the design to apply the provisions of this section to corporations which should thereafter be erected, yet we can by no possible construction exclude those then in being."

The objection of counsel on that point was section 10, article 17, of the constitution—"the General Assembly shall not remit the forfeiture of any corporations now existing, or alter or amend the same, or pass any other general or special law for the benefit of such corporation, except upon the condition that such corporation shall thereafter hold its charter subject to the provisions of this constitution."

But the opinion says this provision was not intended to apply to corporations which, from the nature of their charters, came under the new organic law, and could not claim exemption from "constitutional legislation."

The Pennsylvania charter is inviolable, unless there was reserved when made the right to alter or amend, in which case the constitutional convention, like the Legislature, could modify it. The opinion is that the company did not get authority from the act of 1846 to build its road along Filbert street, but from the act of 1857.

The Court continues : "The company accepted as part of the charter the act of April 15, 1868, and so became subject to the constitutional amendment of 1857, and as a consequence, to the legislative power of the General Assembly. We thus find that the legal status of the Pennsylvania Railroad Co. at the time of the adoption of the constitution of 1874 was in all respects similar to that of the Monongahela Navigation Co. at the time of the passage of the act of 1844, so that we may regard the case of that company against Coon, reported in 6 Barr, 379, as decisive of the controversy in hand."

The judgment of the court below is therefore affirmed. Justices Paxson and Green dissent from the opinion, stating "we are unable to see how the state can avoid its solemn contract by amending its constitution."

In the second case, viz.: the Philadelphia & Reading Co. *vs.* Patent, the action was to recover damages caused by shifting tracks on the street in front of plaintiff's premises. The question at issue was whether the company was liable for consequential damages as charged. As in the case of the Pennsylvania Co., the decision is that the eighth section of article 16 of the constitution of 1874 does embrace these existing corporations, and that the section is applicable to the Philadelphia & Reading Co. On the question of applicability the opinion says : "While the original charter of this corporation dated back to the 4th of April, 1833, yet by the acceptance of subsequent legislation, it was brought within the amendment of 1857 as effectually as though its erection postdated that provision, or as though the terms thereof had been made part and parcel of its organic law." The decision of the lower court was affirmed.

OLD AND NEW ROADS.

Albemarle & Raleigh.—Surveys are being made for the extension of this road from its present terminus at Tarboro, or rather at Rocky Mount, on the Wilmington & Weldon road, westward. The line has been run as far as Nashville, about 12 miles, but its final destination has not been made public.

Baltimore & Ohio.—It is understood that the bill authorizing the construction of this company's proposed bridge over the Arthur Kill will be favorably reported to Congress by the committee.

The New Jersey Senate has passed the Chase bill, which forbids the building of bridges over navigable waters without the consent of the Legislature. This bill was introduced with special reference to the Baltimore & Ohio case.

Boston & Lowell.—This company's engineers are now engaged in laying the new branch to Salem, and have already reached Lynn. The line has of course not yet been definitely settled on, but the only difficulty anticipated is in securing the right of way.

Buffalo, New York & Philadelphia.—The plan of reorganization has been made public by the committee, and bondholders are requested to sign the plan and deposit their securities, in order that it may be carried through as soon as possible. The new plan provides that the present mortgages shall be foreclosed and a new company organized which shall issue $30,000,000 in common stock, $20,000,000 in second-mortgage bonds, bearing interest for 10 years at 3 per cent. and thereafter at 4 per cent., and $10,000,000 first-mortgage 5 per cent. bonds. Of the new common stock $20,000,000 will be used to exchange for the present common and preferred stock, about $6,500,000 for the preferred and $13,500,000 for the common stock, present holders to pay an assessment of $4 per share on the preferred and $6 on the common stock, receiving second-mortgage bonds for the amount of their assessments.

The $20,000,000 second-mortgage bonds will be used as follows : $7,000,000 to be exchanged for the Buffalo, New York & Philadelphia first consols at par, $4,060,000 to exchange for Buffalo, Pittsburgh & Western general mortgage bonds, $2,800,000 to exchange for Buffalo, New York & Philadelphia trust bonds at par, $866,000 to exchange for Pittsburgh, Titusville & Buffalo firsts at par, $1,275,000 to exchange for Buffalo, New York & Philadelphia general mortgage bonds at 75, $375,000 to exchange for Union & Titusville bonds at 75, $2,160,000 to stockholders in exchange for their assessments to be paid, and the remaining $1,463,000 to settle the car trust and floating debt claims.

The $10,000,000 first-mortgage bonds will be used as follows : $3,000,000 to exchange for Buffalo, New York & Philadelphia firsts, $1,000,000 to exchange for Buffalo, New York & Philadelphia seconds, $1,500,000 to exchange for Warren & Franklin firsts, $573,000 to exchange for Oil Creek firsts, $1,427,000 to settle real estate mortgages and other present indebtedness, the remaining $2,500,000 to be used by the new company for the purchase of terminal property and for improvements of the road.

The $10,000,000 new stock not issued in exchange for the present stock of the company will be held in reserve, to be used only on the unanimous vote of all the stockholders voting at a meeting called for the purpose.

California Southern.—A meeting of the stockholders was held in National City, Cal., Feb. 12, at which resolutions were passed approving the conversion of the first-mortgage bonds into income bonds, and the issue of new first-mortgage bonds, in payment of advances made by the Atchison, Topeka & Santa Fe Co. for the repair and extension of the road. The vote was entirely formal, the conversion of the bonds having already been approved by the bondholders, upon whose consent the successful carrying out of the plan depended.

Central, of New Jersey.—The hearing of arguments on the Special Master's report, recommending the termination of the lease of the road to the Reading Co., began in Pittsburgh, Feb. 12, before the United States Circuit Court, and was continued on the following day. On Feb. 13 President Gowen asked the Court for delay in order that he might submit a proposition to the New Jersey Central Co. which, he believed, would put an end to the litigation. The Central counsel stated that they were not prepared to answer, as any proposition must necessarily be submitted to the board of directors for consideration. The Court stated that it would take the responsibility of ordering the postponement in order to give an opportunity for a settlement of the case, as it was of great importance, and that any proposition should have careful consideration. The case was therefore adjourned for 30 days. The nature of Mr. Gowen's proposition has not been made public as yet.

In Philadelphia, Feb. 11, the trustees under the adjustment mortgage filed a bill representing that the conditions of the mortgage had not been complied with, and asking for the appointment of a receiver for the road.

Another complication has been introduced into the litigation by the Lehigh Coal & Navigation Co., which has filed a bill in equity in the United States Circuit Court against the Central Railroad Co. of New Jersey, the receivers of the Philadelphia & Reading Co. and the trustees under the New Jersey Central mortgage. The bill sets forth that the contract under which the Lehigh Coal & Navigation Co. leased its railroad lines to the Central Railroad Co. of New Jersey was in its nature not transferable without the sanction of the stockholders of the lessor company. It also represents that the Central Co., in executing the mortgage upon its property, included in that property the lease of the Lehigh & Susquehanna road, which could not lawfully be done without the consent of the owners of that road. The bill therefore claims that the lease is legally terminated and claims that the Lehigh Coal & Navigation Co. is entitled to assume possession of its railroad lines, and the court is asked to direct that these lines be restored to the possession of the company.

Chicago & Eastern Illinois.—Regarding this company's stock, the Boston *Transcript* says: "Within the last two weeks the Louisville & Nashville Railroad Co., which held 6,000 shares, decided to sell its entire holding, and disposed of the block to a Boston syndicate, who purchased the stock partly for investment and partly to place upon the market here, which readily absorbed all that was offered at between 85 and 86."

Chicago & Northwestern.—Surveys have been begun for a new branch to extend from Metropolitan, Mich., the terminus of a branch of the Peninsular Division, to Crystal Falls and Iron River, the object being to secure a connection with the new iron mines on the Gogebic range, which now have their outlet over the Milwaukee, Lake Shore & Western road. A number of mines have already been opened on this range, and prospects are that there will be extensive shipments of iron ore, a share of which the Northwestern desires to secure.

Cincinnati, Georgetown & Portsmouth.—Trains have commenced to run on the extension of this road to Georgetown, O., which was recently completed. The road is now 42 miles long, from Columbia, O., on the Little Miami road, eastward to Georgetown. A considerable amount has already been expended in putting the old portion of the road in good condition, and more work is still to be done upon the line.

Cincinnati, St. Louis & Texas Pacific.—At the annual meeting in Cincinnati, Feb. 15, Messrs. E. W. Kittredge, Richard Smith and George Hafer were appointed a committee to act with the president and board of directors to take such steps as they deemed best to obtain a modification of the lease under which the company holds and operates the Cincinnati Southern road, and also to obtain such legislation as may be necessary to enable the city of Cincinnati, as owner of the road, to consent to such modifications.

Chicago, St. Louis & Western.—This company has filed a bill in the Superior Court in Chicago against the Union Rolling Stock Co., William A. Adams and others, to amend a contract for the purchase of certain rolling stock, to be paid for in instalments. The plaintiff claims that the contract as instituted, and which the defendant seeks to enforce, differs materially from the agreement originally made, and seeks to have the contract reformed in accordance with the original agreement.

Danville, Olney & Ohio River.—The sale of this road under foreclosure was noted last week. Of the $776,000 first mortgage bonds, all except $10,000 have assented to the reorganization plan. The reorganization of the company contemplates the issue of a new preferred bond to bondholders in return for the 20 per cent assessment to be paid, while

the new mortgage to issue will not exceed $5,000 per mile upon the 95 miles of road. The old mortgage bonds will be converted into a second-mortgage income bond at the rate of 75 per cent. of present holdings, and the balance in common stock. The Corbin interest, which now has full charge of matters, will probably go ahead and try to put the road into such condition as to make it worth something to connecting lines.

Delaware, Lackawanna & Western.—This company's statement to the New York Railroad Commission gives the earnings of its leased lines in New York for the quarter ending Dec. 31 as follows:

	1885.	1884.	Inc or Dec.	P c.
Earnings	$1,634,298	$1,375,001	I. $259,297	18 9
Expenses	662 114	686,508	D. 24,394	3.5
Net earnings	$972,184	$688,493	I. $283.691	41 2
Taxes and rentals	549,246	577,870	D. 28,624	5 0
Surplus	$422,938	$110,623	I. $312 315	282.4

This statement shows a very remarkable increase in both gross and net earnings for the quarter.

Elgin, St. Charles & Southern.—This company has filed articles of incorporation to build a railroad from Elgin, Ill., to Geneva, Wis., about 40 miles. The capital stock is fixed at $250,000.

Erie & Wyoming Valley.—It is reported that this company has finally decided on a line for the extension of its road from the present terminus in Dunmore, Pa., into the city of Scranton. Most of the right of way has been secured and property has been purchased for the passenger station in Scranton.

Fairmont, Morgantown & Pittsburgh.—Regular trains have been put upon this lately completed road, which is operated by the Baltimore & Ohio Co. The stations, with the distances from Fairmont, W. Va., are: Junction, 1; Houlttown, 2½; Catawba, 7½; Opekiska, 13¾; Little Falls, 16¾; Uffington, 21¾; Morgantown, 25½ miles.

Fort Smith & Southern.—This company has been organized to build a railroad from Fort Smith, Ark., southward to a point on the Red River in Texas, a distance of about 150 miles. The organization is in the interest of the St. Louis & San Francisco Co., and its purpose is to build the long-projected southern extension of that road from Fort Smith to Texas.

Fort Worth & Denver City.—The statement for December and the two months of the fiscal year from Nov. 1 to Dec. 31 is as follows:

	—December.—		—Two months.—	
	1885.	1884.	1885.	1884.
Earnings	$33.361	$25,684	$76 874	$61 957
Expenses	27,159	12.399	52,063	29,693
Net earnings	$6,202	$13,285	$24.811	$32,264

For the two months the gross earnings increased $14,917, or 24.1 per cent., and the expenses $22,370, or 75.3 per cent., the result being a decrease of $7,453, or 23.1 per cent., in net earnings.

Georgia Pacific.—It is reported from Atlanta that arrangements have been completed under which the company secures the money needed to complete the gap between the First and Second divisions, and that work will be begun at once on the construction of the line from Birmingham westward, which will complete a continuous line from Atlanta, Ga., to Columbus, Miss. The line was located several years ago and some work has been done upon it.

Jackson Southern.—This company has been organized to build a railroad from Jackson, Minn., on the southern Minnesota Division of the Chicago, Milwaukee & St. Paul, southward about 10 miles to the Iowa line, where connection will be made with a line to be built in Iowa.

Lima Branch.—It is proposed to build a railroad from the town of Lima in Livingston County, N. Y., to Rush Junction, where connection will be made with the Erie and the New York Central roads. The distance is about 9 miles and the estimated cost about $50,000. Subscriptions are now being asked for along the line.

Manhattan.—This company's statement to the New York Railroad Commission for the quarter ending Dec. 31 is as follows:

	1885.	1884.	Inc. or Dec.	P. c.
Earnings	$1,818,200	$1,750.842	I. $67,358	3.9
Expenses	922,710	903,580	I. 19.140	2.1
Net earnings	$895,490	$847,262	I. $48,228	5.7
Other receipts	17,358	19,281	D. 1,923	10.0
Total	$912,848	$866,543	I. $46,305	5.3
Interest, taxes, etc	476,902	438,969	I. 37,933	8.6
Surplus	$435,946	$427,574	I 8,372	1.9

Taxes are included in both years for purposes of comparison, although they were not included for the quarter in 1884. The dividend for the quarter was 1½ per cent., requiring $390,000, and leaving a balance of $45,946.

Marietta & North Georgia.—Work has been pushed on the extension of this road from the late terminus at Elijay, Ga., to Murphy, N. C., a distance of 45 miles. The grading is all completed to Murphy, and at latest accounts track had been laid to the Gilmer County line, 14 miles from Elijay, and the work was progressing steadily. The road from the starting point at Marietta to Murphy will be 115 miles long. It traverses a fine section of North Georgia which is steadily improving, and at Murphy it will reach the iron beds of Western North Carolina which yield ore of a very fine quality. The iron made from this ore has long had a local reputation, and during the war the mines were worked by the Confederate government, for the reason that the iron made from this ore was found better adapted for ordnance than any other which could be secured. There is now a large amount of this ore piled up and ready for use as soon as it can be transported by railroad.

The company will probably extend its line beyond Murphy, and has already graded a line through Red Marble Gap in order to secure possession of that difficult pass.

The business of the older portion of the road is steadily improving. The Georgia Marble Co., which has quarries near the line of the road, is now shipping 10 carloads a day, and has orders ahead for 1,800 carloads, and the other local business shows a fair improvement.

Missouri Pacific.—This company has filed notice with the Secretary of State of Missouri of its intention to build a branch from Labadie in Franklin County, Mo., eastward, following nearly the line of the Missouri River, to Creve Cœur Lake, a distance of 28 miles. At Creve Cœur Lake the new branch will connect with the line already owned by the company from that point to St. Louis, forming a loop line from Labadie to St. Louis which is 3 miles longer than its present line, but which will avoid the heavy grades near Kirkwood.

A contract for the piling and timberwork on the new branch of this company's Iron Mountainline, from Bald Knob to Memphis, has been let to C. O. Richards & Co., who will have the entire work.

Mobile & Ohio.—The St. Louis *Republican* of Feb. 11 says: "Although the leases and the other paper incident thereto in the transaction between the St. Louis & Cairo Railway Co., lessor, and the Mobile & Ohio Railway Co., lessee of the property of the first named company, were only signed yesterday, and the transfer of the road and its appurtenances formally made, the lease dates from Feb. 1, and all earnings and all else concerning the operation and conduct of the property since Jan. 31, now stand in the name of the lessee company, who will continue in possession of the road and its belongings for a term of 45 years at the annual minimum cash rental of $165,000.

"So far as changing the gauge of the Cairo road is concerned, the necessary preparations will be begun at once, and the width changed as soon thereafter as possible, the Mobile road having already been reduced to the standard-gauge. For this work the lessor of the property has set apart $1,000,000 besides the proceeds from the sale of the equipment and motive power, which will be expended in betterments. President Charles Hamilton, of the Cairo road, will continue at the head of that organization, and as such will superintend the work of changing the gauge and the disbursement of the money set apart for that purpose. He will also be the General Superintendent of the Mobile & Ohio north of Cairo.

"The headquarters of the system will be brought to St. Louis, and if they can be secured, the third and fourth floors in the building, corner of Fourth and Olive, now occupied by the St. Louis & Cairo road, will be taken for the general offices of the company, but President Duncan will reside in New York as heretofore."

Natchez, Red River & Texas.—Track on this road is now laid to Trinity, La., 9 miles westward from the old terminus at Frogmore, and 25 miles from the starting point at Vidalia on the Mississippi, opposite Natchez. Work is in progress on the improvement of the older portion of the road from Vidalia to Frogmore. The new terminus, Trinity, is at the point where the Tensas and the Ouachita unite to form the Black River, and is the centre of a considerable local business.

New York, Brooklyn & Manhattan Beach.—This company, which was recently organized by the consolidation of the New York, Bay Ridge & Jamaica, the New York & Manhattan Beach, and the Long Island City & Manhattan Beach companies, filed a consolidated mortgage of $2,000,000 this week in the Register's office, Brooklyn, to the Central Trust Co., of New York. By its term the consolidated company is to issue $2,000,000 of bonds, to run for 50 years. They will bear 5 per cent. interest.

New York, Chicago & St. Louis.—In Cleveland, Feb. 11, upon a hearing before Judge Jones, in the Court of Common Pleas, a temporary injunction was granted the Central Trust Co., of New York, preventing George J. McGourkey and Samuel Shethar from disposing of the equipment of the road. The trustees had advertised the sale of this rolling stock for Monday, Feb. 15.

The Receiver's statement for the quarter ending Dec. 31 is as follows:

	1885.	1884.	Inc. or Dec.	P. c.
Earnings	$957,136	$865,549	I $91.587	10.6
Expenses	614,909	604 332	I. 10,577	1.7
Net earnings	$342,227	$261,217	I. $81.010	31.0
Other income	.....	900	D. 900	100.0
Total	$342,227	$262 117	I. $80,110	30 6

The Receiver does not report interest or other charges. No interest on the bonds was paid during the quarter.

New York, Lake Erie & Western.—It is stated that at the last meeting of the Board of Directors a general overhauling of all the passenger stations on the main line east of Sufferns and on the Newark Branch was ordered. It was also resolved to purchase 20 passenger cars expressly for suburban traffic. It is understood that the company has decided to continue the policy of increasing accommodations for suburban business, which has proved successful as far as it has been carried out.

The statement to the New York Railroad Commission for the quarter ending Dec. 31 is as follows:

	1885.	1884.	Inc. or Dec.	P.c.
Earnings	$5,766,061	$5,141,580	I. $624 481	12 2
Expenses	3,873,474	3,593,565	I. 279,909	7.6
Net earnings	$1,892,587	$1,548,015	I. $344,572	22.3
Other income	272,715	308 048	D. 35 333	11 5
Total	$2,165 302	$1,856,063	I. $309,239	16.7
Charges	1,958,678	1,724,188	I. 234,490	13.6
Surplus	$206 624	$131,875	I. $74,749	56 6

Charges include interest, rentals and taxes. The balance sheet shows $788,815 cash on hand Dec. 31, in New York and London.

New York & New England.—The report to the New York Railroad Commission for the quarter ending Dec. 31 is as follows:

	1885	1884.	Increase.	P. c.
Earnings	$950,500	$790 985	$159 515	20.2
Expenses	581.430	576,672	4.758	0.8
Net earnings	$369,070	$214 313	$154 757	72.3
Other income	21.584	18,902	2,682	14.1
Total	$390,654	$233,215	$157,439	67 6
Charges	455,294	289,926	165 368	57.0
Deficit	$64,640	$56,711	$7,929	13.9

Charges include interest, rentals and taxes. The large increase in their amount last quarter is not explained.

New York, New Haven & Hartford.—The statement to the New York Railroad Commission for the quarter ending Dec. 31 is as follows:

	1885.	1884.	Increase.	P. c.
Earnings	$1,844,529	$1,656,245	$188,284	11.4
Expenses	1,180,595	1,102,660	78,535	7.1
Net earnings	$663,934	$554,185	$109,749	19.8
Other income	11,096	3,528	7,568	214.4
Total	$675,030	$557,713	$117,317	21.0
Charges	204,947	204,947	.....	...
Surplus	$470,083	$352.766	$117,317	33.2

Charges include interest, taxes and rentals. The surplus for the quarter was equal to 3.03 per cent. on the stock, against 2.28 per cent. in 1884.

Omaha & North Platte.—A dispatch from Lincoln, Neb., Feb. 12, says: "Articles of incorporation were filed to-day by an official of the Burlington & Missouri Railroad for the Omaha & North Platte Railroad Co. The road will run from Omaha southwest to Ashland, then will parallel the Omaha & Republican Valley Branch of the Union Pacific as far as the latter extends. The new road will then turn northwest and join, probably at Broken Bow, Custer County, with the Grand Island & Wyoming Central, which has been surveyed and contracted. It will go through a district that will furnish strong local support.

Philadelphia & Reading.—In the United States Court in Philadelphia, Feb. 16, the Court granted the petition of Edward Parsons, of New York, as owner of 100 general mortgage bonds, to be allowed to intervene in the Robinson foreclosure suits. Mr. Parsons is already an appellant in one of the foreclosure suits, and he has now a standing in all the suits pending for foreclosure of the general mortgage bonds. In making the order the Court remarked that there did not appear to be much doing in the affairs of the company except intervening in suits.

The plan of the syndicate which proposes to undertake the reorganization of the company, to which reference was made last week, is set forth as follows in a letter addressed by Messrs. J. Lowber Welsh and J. Pierpont Morgan to the Reorganization Trustees:

"A syndicate has been formed, composed of leading bankers and capitalists here and in Europe, together with corporations or their representatives controlling large transportation and coal-producing interests, who have agreed to subscribe in the aggregate $15,600,000 for the purpose of aiding in the reorganization of the Philadelphia & Reading Railroad Co. and its affiliated lines. The syndicate has no commitments of any kind with any other railroads or corporations upon this subject beyond securing a management in harmony with the principle that capital invested in internal improvements should be so managed as to result in a fair return in the way of interest and dividends. Their object and purpose is to secure the reorganization on business principles for the Philadelphia & Reading Railroad bondholders, stockholders, and creditors without prejudice to the relative position of either, and in their interest only.

"To do this effectually there must be suitable arrangements made with the Pennsylvania Railroad and other kindred coal interests for harmonious relations, in order that suitable prices may be obtained for coal produced and shipped. These objects we shall endeavor to secure, and we now inclose you a copy of a correspondence with Mr. Roberts, President of the Pennsylvania Railroad, on these subjects, which seems to us sufficient to warrant the syndicate in placing reliance upon the assurances given by that company.

"As the reorganization shall proceed, our effort and expectation will be to bring about satisfactory arrangements with all the anthracite coal roads, and also the trunk lines, which shall secure to the Philadelphia & Reading Railroad Co., when reorganized, its just share of the business at remunerative rates.

"The syndicate have believed that your plan was, in the main, suitable for the purpose of reorganization, and that your board was composed of gentlemen who would command the confidence of all parties in interest.

"They therefore prefer to make an arrangement with you, and to aid you in working out the plan.

"But they also think that there should be certain modifications as to your organization, and also as to your plan, as follows:

"1. The syndicate would wish two persons, to be named by them, added to your board.

"2. Your plan should be made so flexible that it can be modified hereafter in such respects as may be found necessary to success.

"3. There should be an executive committee of five to take charge of the foreclosure proceedings, the purchase of the property, the organization of the new company, and generally whatever may properly appertain to reconstruction under the plan.

"There should be five voting trustees, who should vote the stock when deposited under the plan, and to whom the power of voting on the stock in the reorganized company should be confided for five years after the reorganization.

"These two committees shall be composed of parties satisfactory to the syndicate and the trustees, and shall fill their own vacancies. But in case the syndicate and trustees cannot agree upon the five, then, and in that case, three shall be named by the syndicate and two by the trustees, and each class shall fill any vacancy occurring in its own number.

"4. The compensation to be allowed to the syndicate shall be 5 per cent. on the amount of the syndicate capital.

"5. The syndicate to be allowed interest at the rate of 6 per cent. per annum upon any amount they may advance the company in the course of the process of foreclosure and reorganization.

"6. Proper provisions must be made for securing to the syndicate the refunding of the money they may advance on account of interest, not exceeding 4 per cent. per annum on the general mortgage bonds during reconstruction, and also for the substitution of the syndicate in the place of any creditor or stockholder who may abandon his holding and refuse to pay his assessment, it being the purpose of the syndicate to pay 4 per cent. per annum interest on the general mortgage bonds during reconstruction, and also to pay the assessments of such parties as may abandon their holding or right to take the securities to which they may be entitled under the plan."

The correspondence referred to in this letter includes a letter from President Roberts assuring the syndicate that the Pennsylvania Railroad Co. will co-operate with it.

The Reading Reorganization Trustees have considered the syndicate plan and decided to accept it, with some slight modifications, which have been accepted. The Executive Committee, which will have charge of the work of reorganization, will consist of the following gentlemen, if they are willing to serve: For the Syndicate, Samuel Dickson and George C. Thomas (of Drexel & Co.); for the Reconstruction Trustees, H. A. Dupont and Thomas Cochran; joint member, Harry F. West. The Voting Trustees will be: For the Syndicate, J. Pierpont Morgan and John Lowber Welsh; for the Reconstruction Trustees, Henry Lewis and George F. Baer, of Reading; joint member, Robert H. Sayre, Vice-President Lehigh Valley Railroad.

On the other hand President Gowen says that he is organizing a syndicate of his own, and that he will soon be able to raise money to pay off the overdue coupons on the general mortgage bonds, thus preventing any foreclosure under that mortgage. He will oppose actively the new plan by all means in his power.

Richmond & Danville.—In accordance with the resolutions passed by the stockholders at the annual meeting, the directors have appointed a committee to consider and report a plan of union with the Richmond & West Point Terminal Co. The Richmond & Danville holds half the stock of that company already. It is said that the committee is in favor of the issue of one share of Richmond & Danville for two of the Terminal stock.

Southern Change of Gauge.—The Committee on Standard Wheel Gauge, appointed at the convention held in Atlanta, Ga., Feb. 2, met in Atlanta, Feb. 15, and, after a protracted session, adopted a gauge fixing the distance between flanges at 4 ft. 5⅝ in., which is the Master Car-Builders' standard.

The adjourned meeting of the convention was held in Atlanta, Feb. 16, when it was expected that final arrangements would be completed for the general change.

Southern Pacific Co.—A strike of the freight brakemen on the New Orleans end of this company's lines last week has extended to the freight handlers employed at the stations and wharves in Algiers and New Orleans. At latest ac-

counts all freight traffic over the road is stopped, and the company is unable to unload its steamers.

Texas & Pacific.—Counsel for John E. Parker, of Chicago, have filed a bill in equity against this company and the New Orleans Pacific in the United States Circuit Court in New Orleans. The plaintiff brings his suit on the first-mortgage bonds issued by the New Orleans, Baton Rouge & Vicksburg Railroad Co., and seeks to enforce the lien of those bonds upon the lands originally granted to the New Orleans, Baton Rouge & Vicksburg, better known as the Backbone Railroad Co., and which afterwards passed to the New Orleans Pacific as assignee of the first-named company. The New Orleans Pacific is now the property of the Texas & Pacific Co., which owns all the stock.

Virginia Railroad Commission.—The Virginia Legislature has defeated a bill providing for a board of three commissioners to take the place of the present railroad commissioner and granting enlarged powers to the commission. The bill has been under discussion for nearly two weeks and was finally defeated by a very small majority.

Wabash, St. Louis & Pacific.—The sale of this road is to take place on April 23. The Committee of Reorganization publish a notice to holders of stock and invite them to subscribe for the new stock, by signing the subscription books, now open at the office of the committee, No. 195 Broadway, New York. Payments will be due as follows: On preferred stock, $3 per share, April 10, 1886; on preferred stock, $2 per share, May 10, 1886; on preferred stock, $3 per share, June 10, 1886; on common stock, $2 per share, April 10, 1886; on common stock, $2 per share, May 10, 1886; on common stock, $2 per share, June 10, 1886. Stockholders who do not subscribe for the new stock under these conditions on or before April 10, 1886, will forfeit all right to the same.

Wisconsin Central.—It has been for some time past uncertain whether this company's agreement for the use of the Chicago, Milwaukee & St. Paul tracks into Milwaukee would be allowed to continue after the opening of the Wisconsin Central new line to St. Paul. A correspondence is now published between Manager Finney, of the Central, and Manager Miller, of the St. Paul road, in which the latter states that the matter was recently considered by the directors of the St. Paul Co., and that it had been decided to continue to permit the Central to use the tracks of the St. Paul road into Milwaukee; and furthermore, that an amicable agreement might be made for the use of the new passenger station in Milwaukee.

The Minnesota, St. Croix & Wisconsin Co., which owns the Wisconsin Central line to St. Paul, has filed notice of a lease giving it the right to use the tracks of the Chippewa Falls & Western road, from Chippewa Falls, Wis., to Eau Claire, for the term of 99 years, beginning Jan. 1, 1885.

ANNUAL REPORTS.

The following is an index to the annual reports of railroad companies which have been reviewed in previous numbers of the current volume of the *Railroad Gazette:*

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Denver & Rio Grande.

The statement of the Receiver of this road for the year ending Dec. 31 gives earnings of the road as follows:

	1885.	1884.	Inc. or Dec.	P. c.
Earnings	$6,119,053	$5,552,003	I. $566,950	10.2
Expenses	3,935,273	3,758,530	I. 176,743	4.7
Net earnings	$2,183,780	$1,793,573	I. $390,207	21.8
Gross earn. per mile.	4,646	4,216	I. 430	10.2
Net " "	1,658	1,362	I. 296	21.8
Per cent. of exps	64.3	67.7	D. 3.4	....

The mileage worked was the same in both years, no additions having been made last year. Both gross and net earnings show considerable gains.

The Receiver's income statement for the year is as follows:

Net earnings, as above	$2,183,780
Miscellaneous receipts	68,313
Total	$2,252,093
Current charges, rent of equipment, etc	573,454
Balance	$1,678,639

The yearly interest charge on the funded debt is $1,953,610, or $274,971 in excess of the surplus noted above. The amount of that surplus was sufficient to pay 5 per cent. on all the bonds and leave a balance of $247,489 besides.

New York, Susquehanna & Atlantic.

This company owns a line from West End, N. J., to Unionville, N. Y., 71¼ miles; a branch from Two Bridges, N. J., to Stroudsburg, Pa., 53 miles, and three short branches, 9½ miles, making 134 miles in all. It leases the Middletown, Unionville & Water Gap road, Unionville to Middletown, 14 miles, and the Lodi Branch, 2 miles, making 150 miles worked.

From West End to Jersey City and New York the company uses the tracks, stations and ferries of the Pennsylvania Railroad. The company makes the following statements of its operations for the year ending Dec. 31.

The earnings for the year were as follows:

	1885.	1884.	Inc. or Dec.	P.c.
Earnings	$1,092,354	$1,034,208	I. $58,146	5.6
Expenses	617,520	617,688	D. 168	..
Net earnings	$474,834	$416,520	I. $58,314	14.0
Gross earnings per mile.	7.282	6,895	I. 387	5.6
Net " " "	3,166	2,777	I. 389	14.0
Per cent. of exps	56.5	59.7	D. 3.2	..

The coal tonnage carried was 608,072 tons, against 475,347 in 1884; an increase of 132,725 tons, or 29 per cent.

The income account was as follows:

Net earnings, as above		$474,834
Rentals	$25,000	
Interest	411,000	
Car trusts	83,192	
		519,192
Deficit for the year		$44,358

In this statement full interest is charged on the bonds. The company, however, paid only one-half interest on the new 6s and the debenture 6s, funding the other half. This half interest unpaid amounted to $93,000, so that the actual payments show a surplus of $48,642, instead of a deficit as above.

Lehigh & Wilkes-Barre Coal Co.

This company controls, by ownership or lease extensive anthracite coal properties in the Lehigh and Wyoming districts. It was organized in the interest of the Central Railroad Co. of New Jersey, and is controlled by that company. The report is for the year ending Dec. 31.

The receipts and charges for the year were as follows:

Sales of coal and coal leases		$6,843,157
Rents, interest, etc		67,959
Coal on hand Dec. 31 (135,434 tons)		243,468
Total receipts		$7,254,584
Coal on hand Jan. 1 (78,814 tons)	$200,127	
Mining, royalty and coal bought	3,030,026	
Transportation, yards and wharves	2,807,107	
Salaries, legal expenses and taxes	152,742	
Interest	704,704	
Sinking funds	269,170	
		7,163,876
Balance, surplus for the year		$90,708

The report of the President, Mr. W. H. Tillinghast, says: "The lower price obtained for coal was partially overcome by economies in mining, and still further by increased production and somewhat lower transportation rates. The mines operated in the Wyoming Division worked but 170 days, and those in the Honey Brook or Lehigh Division 203 days, in which time the production was 2,212,022 tons, as compared with production in 1884, 2,070,264 tons. With a demand for coal that would allow more steady and regular work, the output from the present workings should be not less than 3,000,000 tons per year.

"The usual charges for sinking funds have been made at the cost of the business, amounting to $269,170, from which there has been applied directly to the reduction of the mortgage indebtedness, $116,892, and added to the funds in the hands of the Fidelity Insurance, Trust & Safe Deposit Co., of Philadelphia, account of redemption of Lehigh Coal & Navigation Co. loan of 1894, $47,321, making total payment on mortgage indebtedness of $164,213."

Consolidation Coal Co.

This company owns an extensive coal property in the Cumberland Region; it also owns and operates the Cumberland & Pennsylvania road, built to serve the mines in that region, which extends from Cumberland, Md., to Frostburg, 38 miles, with 17 miles of branches. The report is for the year ending Dec. 31.

The coal mined and delivered from the company's mines last year was 710,064 tons, against 689,212 in 1884, an increase of 20,852 tons, or 3 per cent.

The receipts and expenses for the year were as follows:

Mines, railroad, rents, etc		$2,055,312
Expenses and renewals		1,750,772
Net receipts		$304,540
Interest paid	$147,527	
Sinking fund payments	20,000	
Dividend paid Jan. 28, 1886	102,500	
		270,027
Balance, surplus to profit and loss		$34,513

The balance to credit of profit and loss Dec. 31, 1884, was $31,760. There was carried to the royalty fund in 1885 the sum of $35,584, making that total fund $149,083. This royalty fund is invested in interest bearing securities, and it is proposed to maintain and add to it hereafter as a representative (in addition to the existing sinking fund) of the value of the coal which will be mined in the future from the company's property. The company also holds as a cash asset $100,000 of first mortgage bonds of the Cumberland & Pennsylvania Railroad, acquired in 1875 by the payment of $98,600 in cash from earnings, as mentioned in previous annual reports. The amount to credit of profit and loss on Dec. 31, 1885, was $30,688.

The President, Mr. Charles F. Mayer, says in his report: "The continued commercial and manufacturing depression of the past year and the more than usually severe competition between the several coal producing regions have rendered the year 1885 a very unprofitable one to companies supplying steamer coals to consumers on the Atlantic seaboard.

"The extensions and improvements in the mining department, referred to in last annual report, have been successfully continued, and are fully accomplishing the economies and enlarged facilities anticipated therefrom. All the expenditures for this work have been included in expenses. The company's two iron steam colliers referred to in last annual report have been constantly employed in the service of the company during the past year, furnishing very effective and important aid in its large coastwise trade. The railroads of the company have been improved during the year by the addition of 130 tons of heavy steel rails, and every branch of this department has been maintained in superior condition. The whole main line and a large part of the Eckhart Branch are now laid with heavy steel rail."

Virginia Midland.

This company operates a main line from Alexandria, Va., to Danville, 232½ miles, with branches from Manassas Junction to Strasburg, 63 miles; Junction to Warrenton, 9 miles; Orange to Gordonville, 9 miles; Madison Run to Taylor Mine, 4½ miles, and Franklin Junction to Rocky Mount, 37 miles, making 355 miles in all. Of the main line 28 miles, from Orange to Charlottesville, are owned by the Charlottesville & Rapidan Co., and the branch to Rocky Mount is owned by the Franklin & Pittsylvania Co., but those organizations are controlled and practically owned. In addition to the line worked, the company owns 52 miles, from Strasburg to Harrisonburg, which are leased to the Baltimore & Ohio Co. at a rental of $89,250 yearly. The report is for the year ending Sept. 30.

The general account, condensed, is as follows:

Capital stock		$5,962,017
Old stock not exchanged		37,983
Funded debt		7,635,000
Income bonds (including $12,018 scrip)		4,000,000
Accrued interest on income bonds		219,669
Accounts and balances		218,479
Bills payable		226,563
Total		$18,299,711
Road and equipment	$16,416,236	
Co.'s stock and income bonds	1,392,619	
Sundry securities	7,200	
Materials	94,499	
Accounts receivable and cash in transit	249,457	
Income account, debit balance	139,700	
		18,299,711

The funded debt consists of $600,000 first series 6s; $1,900,000 second series 6s; $1,100,000 third series 5s; $950,000 fourth series 3s; $1,775,000 fifth series 5s and $1,310,000 sixth series 4s. The securities held by the company include $332,982 income bonds and $1,059,637 stock.

The earnings for the year were as follows:

	1884-85.	1883-84.	Inc. or Dec.	P.c.
Freight	$724,370	$778,749	D. $54,379	7.0
Passengers	566,983	582,034	D. 15,051	2.6
Mail and express	151,273	155,986	D. 4,713	3.0
Miscellaneous	22,500	19,811	I. 2,689	13.5
Total	$1,465,126	$1,536,580	D. $71,454	4.6
Expenses	990,432	999,217	D. 8,785	0.9
Net earnings	$474,694	$537,363	D. $62,669	11.7
Gross earn. per mile	4,127	4,228	D. 201	4.6
Net " "	1,337	1,514	D. 177	11.7
Per cent. of exps	67.6	65.0	I. 2.6	....

Earnings were reduced by a very short wheat crop along the line and by the general dullness in the mineral traffic.

The result of the year was as follows:

Net earnings, as above		$474,694
Rent of Strasburg-Harrisonburg line		89,250
Total		$563,944
Interest paid	$380,466	
Rentals paid	43,300	
		423,760
Balance		$140,184
Interest accrued on income bonds		219,669
Deficit for the year		$79,485
Debit balance, Oct. 1, 1884		32,708
Back taxes, etc., paid		27,507
Debit balance, Sept. 30, 1885		$139,700

The amount expended for new construction and equipment was $89,836, which deducted from the balance after paying interest and rentals leaves $50,348 for the income bonds, or about 1¼ per cent.

The traffic reported for the year is as follows:

	1884-85.	1883-84.	Decrease.	P.c.
Passenger train miles	574,260	.....	.....	....
Freight " "	546,395	.....	.....	....
Total locomotive miles	1,351,517	.....	.....	....
Freight car miles	7,269,018	.....	.....	....
Passengers carried	378,136	386,224	8,088	2.1
Tons freight carried	410,757	438,002	27,245	6.2

Of the freight car mileage last year 67.9 per cent. was of loaded cars. The average earnings per passenger train-mile were $1.25; per freight train mile, $1.33. Locomotive service cost 20.45 cents per mile run. Locomotives ran 1.21 miles to each revenue train mile.

During the year 1,500 tons of steel rails and 167,914 new ties were used in renewal; a new iron bridge was built over the James River; 8,100 ft. new sidings were built and 12¼ miles of track were ballasted with stone. There are now 67¼ miles of iron rails in the main track.

Contracts have already been let for 11 new iron bridges to replace wooden structures, and for steel rails for 7 miles of track. It is intended to use about 10 miles more of steel during the year.

Contracts have been let for 50 box and 50 stock cars, and negotiations are pending for the purchase of 5 heavy freight locomotives.

On July 1, 1885, a payment of 3 per cent. was made on the income bonds, being the coupon of July 1, 1884, leaving the interest still one year behind.

Western Maryland.

This company owns a line from Baltimore to Williamsport, Md., 90 miles, and leases the Baltimore & Cumberland Valley road, from Edgemont, Md., to Shippensburg, Pa., 33.6 miles. It also leases the use of 3 miles of the Northern Central and the Baltimore & Potomac track in Baltimore, making 126.6 miles worked. The report is for the year ending Sept. 30.

The road is controlled by the city of Baltimore, that corporation having indorsed most of the bonds and made large advances and loans to the company.

The general balance sheet, condensed, is as follows:

Stock subscriptions		$682,950
Funded debt		3,675,000
Bills payable and car-trust notes		293,372
Improvement loans and accounts		56,002
General revenue		400,508
Total		$5,107,832
Road and equipment	$5,023,202	
Sinking fund, second mortgage	30,000	
Materials	8,847	
Balances receivable	7,711	
Cash	38,072	
		5,107,832

The funded debt includes $600,000 firsts ($200,000 indorsed by the city of Baltimore); $600,000 preferred seconds; $600,000 seconds, one-half indorsed by Baltimore and one-half by Washington County; $875,000 thirds, indorsed by Baltimore; and a fourth mortgage for $1,000,000 to the city of Baltimore, for which no bonds have been issued.

The earnings for the year were as follows:

	1884-85.	1883-84.	Inc. or Dec.	P. c.
Passengers	$243,327	$269,292	D. $25,965	9.6
Freight, milk and express	358,308	375,995	D. 37,687	10.0
Mails, etc	37,582	20,709	I. 16,873	81.5
Total	$619,217	$665,996	D. $46,779	7.0
Expenses	387,082	407,750	D. 20,668	5.1
Net earnings	$232,135	$258,246	D. 26,111	10.1
Gross earn. per mile	4,891	5,261	D. 370	7.0
Net " "	1,834	2,040	D. 206	10.1
Per cent. of exps	62.5	61.2	I. 1.3	....

The expenditures for betterments during the year were $161,125. The earnings suffered from the general depression of business in Baltimore and along the line.

The traffic for the year was as follows:

	1884-85.	1883-84.	Inc. or Dec.	P. c.
Locomotive miles	807,092	884,197	D. 77,105	8.7
Passengers carried	672,316	722,414	D. 50,098	6.9
Passenger-miles	14,602,158	16,512,178	D. 1,910,020	11.6
Tons freight carried	285,485	311,025	D. 25,540	8.2
Ton-miles	11,670,486	13,114,956	D. 1,444,470	11.0
Average rate:				
Per passenger-mile	1.67 cts.	1.63 cts.	I. 0.04 ct.	2.4
Per ton-mile	2.51 "	2.52 "	D. 0.01 "	0.4

The passengers last year were classified as follows: Full fare, 254,408; two-thirds fare (ministers), 4,033; half-fare, 8,711; commutation and mileage tickets, 160,990; excursion, 244,174; total, 672,316.

Improvements during the year included 1,200 tons of steel rails and 43,750 new ties; new sidings aggregating 12,469 ft.; several new stations and other buildings; interlocking signals and switches at the Cumberland Valley crossings at Hagerstown; several new iron bridges and two iron viaducts, replacing wooden bridges. All the main line but two miles is now laid with steel. Payments on the car trusts amounted to $64,036. All improvements were paid for out of revenue.

Negotiations are pending for a reduction of the rental paid for the use of the Northern Central and the Baltimore & Potomac tracks in Baltimore, thus far without result. These rentals last year amounted to $75,236, and it is thought by the officers of this company that they are unreasonably large.

Cincinnati, New Orleans & Texas Pacific.

This company owns no road, but operates as lessee the Cincinnati Southern road, from Cincinnati to Chattanooga, Tenn., 335.92 miles, which is owned by the city of Cincinnati. The report is for the year ending Dec. 31 last, the fourth full year of the lease.

The equipment, which is owned by the company, consists of 62 locomotives; 27 passenger and 14 baggage cars; 1,302 box 247 stock, 60 refrigerator, 93 fruit, 6 oil tank, 311 flat, 369 coal and 35 caboose cars; 2 derrick and 17 boarding cars and 1 steam-shovel.

The general balance sheet, condensed, is as follows:

Capital stock		$3,000,000
Reserve for sinking fund		167,324
Replacement of rolling stock fund		33,647
Accounts and balances		486 682
Rental accrued, but not due		378,989
Balance of revenue account		65,926
Total		$4,132,568
Equipment and betterments	$3,304,679	
Materials	97,246	
Sundry accounts and balances	671,360	
Cash	59,283	
		4,132,568

The company has no funded debt. The rental paid for the road is $812,000 up to the end of the current year; then $912,000 yearly for five years and afterwards $1,012,000.

The earnings for the year were as follows:

	1885.	1884.	Inc. or Dec.	P. c.
Freight	$1,875,780	$1,855,856	I. $19,924	1.1
Passengers	662,971	654,197	I. 8,774	1.4
Mail and express	106 181	99 703	I. 6,478	6.5
Miscellaneous	36,614	48,428	D. 11,814	24.5
Total	$2,6 1.546	$2.658,184	I $23,362	0.9
Expenses	1,616,735	1,754,174	D. 137,439	7 8
Net earnings	$1,064 811	$904,010	I. $160,801	17.8
Gross earn. per mile.	7,981	7,911	I. 70	0.9
Net " "	3,169	2,691	I. 478	17.8
Per cent. of exps	60.3	66.0	D. 5.7	...

The increase in net earnings was secured chiefly by the reduction in working expenses. Taxes are not included in expenses.

The expenses were divided as follows:

	1885. Amount.	P.c.	1884 Amount.	P.c
Conducting transportation	$344,247	24.0	$6 5,216	25.4
Motive power	420,347	15.7	435,349	16 4
Maintenance of cars	111,913	4.2	129.450	4.9
Maintenance of way	327,314	12.2	405 029	15.2
General expenses	112,914	4.2	109,130	4.1
Total	$1,616,735	60.3	$1,754,174	66 0
Taxes	93,800	3.5	82,800	3.1
Total	$1,710,535	63.8	$1,836,974	69.1

The greatest reduction last year in expenses was in maintenance of way, being $77,716, or 19.2.

The result of the year was as follows:

Net earnings, as above		$1,064,811
Taxes	$93,800	
Rent of road	812 000	
		905,800
Balance, surplus for the year		$159,011
Carried to reserve for sinking fund	$47,211	
Debit balance, Jan. 1, 1885	45,874	
		93,085
Balance, surplus, Dec. 31, 1885		$65,926

Expenditures on capital account during the year were: Roadway and structures, $133,287; equipment, $24,411; change of gauge, $3,048; total, $160,746.

The traffic for the year is as follows:

	1885.	1884.	Inc. or Dec.	P.c.
Passenger train mi'es	739,833	730,773	I. 9,060	1.2
Freight " "	986,790	929 779	I. 57,011	6.0
Total locomotive miles	2,301,894	2,254,725	I. 47,169	2.1
Freight car miles	21,400,766	20,384,359	I. 2,016,407	9.8
Passengers carried	587.175	639,902	D. 52,727	8.2
Passenger-miles	30,404 961	28,867,376	I. 1,537,585	5.3
Tons freight carried	979,421	917,292	I. 62.129	6.8
Ton miles	179,614,266	166,453,790	I. 13,160,476	7.9
Av train load:				
Passengers, No	41.1	39.5	I. 1.6	4 1
Freight, tons	182.0	179.0	I. 3.0	1 7

Of the freight car mileage last year 74.6 per cent. was of loaded cars. Locomotives ran 1.33 miles for each revenue train mile. Locomotive service cost 15.97 cents per mile run.

The average earnings and expenses per train mile and per unit of traffic were as follows, in cents:

	Passenger. 1885.	1884.	Freight 1885	1884.
Per train mile:				
Earnings	105.00	104.00	187 00	196.00
Expenses	65.00	81.00	115.00	125.00
Net	40.00	23.00	72.00	71.00
Per pass. or ton mile:				
Earnings	2 18	2.26	1.03	1.10
Expenses	1.59	2.06	0 63	0 70
Net	0.59	0.20	0.40	0.40

The earnings per ton-mile last year were: Through, 0.87; local, 1.46; average, 1.03 cents.

The General Manager's report states that his efforts since his taking charge of the road have been directed chiefly to securing a proper plan for the adjustment of rates and the manner of computing divisions. In this he has been successful, and an agreement has been reached placing all the roads competing for southern business on a uniform and equitable basis, and a further agreement has been made for pooling all competitive business and placing it in charge of a commissioner. This agreement is to continue for five years.

He refers also to the advantages which will be secured by the approaching change of the road to standard gauge, which will do away with the expenses now attending the transfer and car hoist in Cincinnati, besides greatly reducing the amount of terminal switching required.

During the year there were 21.80 miles of iron rails and 2.85 miles of light steel rails replaced by new 60-lb. steel rails; there were 2.73 miles of new siding laid; 1,903 lineal feet of tunnel arched with brick, and much work done in ballasting track and in filling in trestles. There are now only 39.78 miles of road still laid with iron rails.

The expenditures on capital account required during the current year will be for the substitution of steel for the remaining iron rails, some additional track and grading in the Cincinnati yard, the arching of 4,330 ft. of tunnel and the change of gauge of the entire line.

The President's report refers at considerable length to the litigation on the question of the taxation of the road in Kentucky, which has been finally decided against the company by the United States Supreme Court, this decision vesting in the Railroad Commission of the state the power to fix the valuation of railroad property.

The report also refers at considerable length to the litigation over the stock over-issue by George F. Doughty when Secretary of the company. The company has secured a decision which is practically to the effect that it is not responsible for the over-issue of stock, although the case has not been finally decided, but has been remanded to the Supreme Court for a new trial.

The terminal expenses in Cincinnati still continue large, having amounted to $141,548 last year, owing to the failure of the trustees to provide proper terminal grounds. The company has bought about 16½ acres of land adjoining the 5½ acres owned by the city to be used for freight station and yards. The ground just bought is below grade and will have to be filled up. It is, however, advantageously situated, being close to the principal manufacturing quarter of the city, and will afford sufficient accommodation when graded and brought into use.

The President repeats the complaint made in last year's report as to the onerous nature of the lease, and suggests two courses: First, that the company surrender the lease on the ground that the city of Cincinnati had not performed its part of the contract, in that it has not furnished any terminal facilities in the city, thus imposing a heavy additional burden upon the lessee. The other course, which is that recommended by the company, is that for the current year the city shall accept from the company $712,000 in cash and $100,000 in an obligation of the company; for the five years following the company to pay $712,000 in cash and $200,000 in its obligations, and for the eleventh year $812,000 in cash and $200,000 in its obligations. This arrangement would make in all $1,300,000 of deferred rental, for which the city will hold the company's obligations, secured by mortgage on its equipment and other property owned, on which interest would be paid at the rate of 4 per cent. yearly, this deferred rental to be paid at the rate of $100,000 yearly from the thirteenth year of the lease to its conclusion. The money so retained by the company will be needed for improvements of the road and terminal property. This plan the board suggests as an equitable adjustment of the differences between the city of Cincinnati as owner and the company as lessee. To carry it out will require considerable negotiation.

Lehigh Coal & Navigation Co.

This company owns a great coal property in the Lehigh and Wyoming anthracite regions; it owns the Lehigh Canal from Mauch Chunk, Pa., to Easton, and leases the Delaware Division Canal from Easton to Bristol. It also owns the Lehigh & Susquehanna road from Easton to Wilkes-Barre, 105 miles, with 50 miles of short branches, and leases the Lehigh & Lackawanna, 25 miles; the Nesquehoning Valley road, 17.5; the East Mahanoy connection, 3.5 miles, and the Tresckow road, 6.5 miles. These railroads, 207.5 miles in all, were leased to the Central Railroad Co. of New Jersey, and are now leased, with that road, to the Philadelphia & Reading Co. The figures below are from the report of the managers for the year ending Dec. 31:

The general account, condensed, is as follows:

Capital stock		$12,675 650
Funded debt		13.493.750
Bills payable		974.000
Construction loans		877.724
Ground rents and mortgages		161,157
January interest and dividends, etc		124,341
Profit and loss		88,082
Dividend fund		683,841
Total		$29,077,545
Railroad, canal and coal property	$26,027.296	
Supplies and coal on hand	248.677	
Stock and bonds owned	2,253,001	
Bonds and mortgages	15,531	
Bills receivable and accounts	248 098	
Cash	304 941	
		29,077,545

Stock includes 3,743 shares ($187,150) held by the company. The funded debt does not include $3,557,500 loans assumed by the New Jersey Central Co. and the Lehigh & Wilkes-Barre Coal Co.

The income account for the year is as follows:

	1885.	1884.
Railroads and Nesquehoning Tunnel	$1,459,035	$1,458,200
Lehigh Canal and water powers	65,971	97.968
Del. Div. Canal " "	11.038	58.951
Profit on Lehigh coal	396,108	370,102
Royalty, rents, etc	52,524	63,330
Total revenue	$1,984,676	$2,048,551
General and legal expenses	59,454	58.461
Rent and taxes, Nesq. Vy. R. R.	74.081	97,050
" " Del. Div. Canal	61,965	69,921
Taxes	80,039	80,078
Interest account	844,488	854.069
Total expenses	$1,119,027	$1,159,579
Net earnings	$865,649	$888 972

The disposition made of the net earnings for last year was as follows:

Net earnings, as above		$865,649
Sinking fund, 10 cents a ton on 935,579 tons	$93,558	
Depreciation on coal improvements	86.869	
Dividends on stock	681,315	
		861,742
Balance, credited to dividend fund		$3,907

The dividends paid on stock last year were 5½ per cent.; in 1884 they were 6 and in 1883 they were 5½ per cent.

The gross receipts of the company's railroads during 1885, as compared with 1883 and 1884, were as follows:

	1883.	1884.	1885.
Passengers and mails	$224,777	$211.667	$188,765
Freight and express	682 505	685,555	675,134
Coal	3.868.443	3.239 907	3.233 674
Total	$4,775.785	$4 137.129	$4.097,573
One-third of gross receipts	1,591,928	1,379,043	1,365,844
Add balance required to make up guaranteed minimum rental		35,357	48,556
Rental due L. C. & N. Co	$1,5 1 9 8	$1,414 400	$1.414.400

The coal tonnage on the Lehigh & Susquehanna Railroad and the canal showed an increase of 231,789 tons, or 4.8 per cent., as follows:

	1885.	1884.
Delivered east of Mauch Chunk by rail	4,174,900	3,823,161
" " " " by canal	441.497	478.759
Consumption on line above Mauch Chunk	141,053	132.562
Delivered to connecting lines above M. C.	293,730	387,909
Total	5,054,180	4.822,391

The report says: "The earnings of the Lehigh & Susquehanna Railroad decreased this year $39,596, although the tonnage-mileage of coal and freight increased; coal and merchandise freight rates have fallen much below the already low rates of 1884. The tonnage of merchandise freight was larger than ever before, and that of coal was only exceeded in 1883.

"The most serious decrease in our earnings was on the canals. Freshets and ice delayed the opening of navigation nearly three weeks beyond the time at which we began to move boats in 1884, and a very heavy rainstorm which carried away an aqueduct on the Delaware Division Canal and did other damage of less magnitude, turned August, which is usually a month of large canal earnings, into a month of losses. These causes and the low rates of freight which prevailed made the canal earnings this year lower than they have been since we resumed the possession of our canals in 1877. Our navigation system does, however, ordinarily yield a large sum in net earnings, having averaged in the last eight years $140,321 per annum, and as it is not probable that rail freights will be further materially reduced, we may expect that the canals will continue to produce a considerable revenue.

"Our coal business shows satisfactory results. The mines produced 1,127,291 tons during the year; the yield in September, which was the month of the largest tonnage, being 124,569 tons. These are much the largest tonnages that our coal property has ever attained, and this large output was accompanied by a considerable reduction in the cost of production, which, calculated on the same basis as it has been in past years, was $1.387 per ton, a decrease of 18.4 cents below that at of 1884, and lower than any year since our mines were returned to the Company's possession except 1879. In this statement of cost, however, is included the expense of hauling from the breakers to the weigh scales, which is usually classed as a lateral transportation charge and not as an item in the coal-cost. If this should be deducted, the cost of coal for 1885 would be $1.304 per ton."

The report says that the option of the stockholders of the Delaware Division Canal Co. to convert their stock into stock of the Lehigh Navigation Co. ceased on March 10, 1885, and resulted in the conversion of 29,642 shares out of the total of 32,667 shares of that company's stock. The net earnings of this canal having fallen much below the sum needed to pay the charges required by the lease, a new agreement has been made, by which only the net earnings on the Delaware Division Canal will be paid to that company, the lessee company guaranteeing that the payment shall be sufficient to enable it to pay dividends of 4 per cent. per annum on all stock other than that owned by the lessee. The Lehigh Navigation Co. also agrees to deposit with the trustees of the sinking fund of the Delaware Division Canal's first mortgage such bonds of that issue as it now owns. This will fulfill for about 7 years to come the requirements of the sinking fund, which are guaranteed by the lease.

The report further says that "the railroad connecting the Nesquehoning Valley Railroad with the East Mahanoy Railroad was completed during the past year at a cost of $60,672, and delivered to the Reading Railroad, we being repaid for our expenditure by the cancellation of an equal amount of the Lehigh & Susquehanna Construction loan held by that company."

The company has established a beneficial fund for the workmen and their families in case of injury or death, which is working satisfactorily.

Unlike most corporations, the company shows a steady diminution of fixed charges. The interest, taxes, rentals and general expenses for 1885 are $231,027 less than they were in 1878, yet during the intervening years large improvements have been made in the properties of the company; extensive coal tracts have been bought, the capacity of the mines has been almost doubled, and new outlets for eastern business have been obtained. The annual revenue for 1885 was more than double that for 1878, and the output of coal was nearly three times as much.

In the present valuation of the company's assets the value of the Lehigh Canal has been reduced by $2,199,906, which has been charged to profit and loss. The valuation now put upon the Lehigh Canal and the company's interest in the Delaware Division Canal is a figure which would have yielded in the average of the last eight years over 4 per cent. per annum.

The report says, in conclusion: "The amount of coal for which we have to find markets has steadily and rapidly increased of late years, rising from 430,987 tons in 1878 to 745,942 tons in 1881, and with the Alliance coal to 1,270,737 tons in 1885, and this increase has obliged us to seek new markets for our product, which we have done, giving preference to those which permitted the passage of the coal as far as possible over our railroad lines and those of our allies. A considerable quantity of the larger sizes of our coal has found ready sale in Northern New York, Canada, and the West, following our lines to near Scranton, and we have in the last two years developed a considerable all-rail trade with Eastern New York and interior New England. The railroads leading in that direction were mostly in the ownership or control of the coal companies of the Wyoming and Lackawanna valleys, and the only advantageous outlet that remained was over the Lehigh & Hudson River Railway, which, with its connections, forms a direct line with easy grades from the eastern terminus of our railroad at Phillipsburg to the Hudson River at Newburg. Our trade over this railroad has grown from 47,064 tons in 1884 to 84,539 tons in 1885, and shows promise of much larger growth, as our larger sizes of coal sell freely throughout New England for smelting and the allied processes at 50 cents per ton more than the softer anthracites which have hitherto held that market.

"In order to secure this trade we have in the past year made an agreement with the Lehigh & Hudson River Railway Co., which guarantees that we shall for a term of ten years have the use of its railroad system on as favorable terms as are accorded to any one. To make this agreement secure we have exchanged with stockholders of that company 2000 shares of our stock, of the par value of $100,000, for 4000 shares of its stock, of the par value of $400,000, and we and certain of its stockholders have put the majority of the whole capital stock into a trust to carry out the agreements above recited. We have thus acquired an important outlet without incurring any liability on account of the Lehigh & Hudson River Railway Co., or any charge of any kind beyond the amount of the dividends that we may pay on such of our stock as was delivered to the stockholders who exchanged with us; and as this railroad furnishes a very direct line for the exchange of coal going east to New England, and iron ores from the Hudson River and Lake Champlain destined westward to the Pennsylvania blast furnaces, and as there are large deposits of iron ore and limestone on its own line, and as the country through which it passes is a good agricultural region, it is probable that its earnings will be large enough to make our investment in its stock remunerative, irrespective of the advantages which it furnishes as an avenue for our coal to desirable markets.

"Our relations with the Philadelphia & Reading Railroad Co. and with the Central Railroad Co. of New Jersey have been satisfactory throughout the past year, the payments on account of the lease of the Lehigh & Susquehanna Railroad and branches being promptly made. Some complications may ensue from the recent judicial action which foreshadows the termination of the lease under which the former company holds the property of the latter and operates its railways, but after careful and thorough consideration we are advised by counsel of our ability to protect ourselves completely. Our railroad system yields a large revenue to the lessees after deducting from its earnings the rental paid to us, and should we think it best to assert and enforce our entire independence of both the companies with whom we made the agreement of May 29, 1883, we shall be able to operate the Lehigh & Susquehanna Railroad and branches very much to our advantage. We have heretofore assured these companies that we do not desire to add to their embarrassments, but we do not intend that any action which may be taken shall in any way impair our revenue or injure our interests."